American Machinist

Volume 57 NEW YORK, JULY 20, 1922 Number 3

A Factory That Fits the Job

Laying Out a Manufacturing Plant with Future Developments in Mind—Selecting Machinery, Transportation Equipment and Fixtures on an Economic Basis

By G. I. RHODES

INDUSTRIAL construction in 1920 proved to be so costly that many new factories are now "white elephants" on the hands of their owners. A notable exception is the plant of the Syracuse Washing Machine Corporation. Built during that trying year of 1920, its burden is eliminated by its economies. It is pre-eminently "A Factory that Fits the Job."

The Syracuse Washing Machine Corporation in 1919 occupied rented factory space which was rapidly becoming inadequate to meet the demand for washing machines. Rented facilities had been increased from time to time and in the fall of that year it became evident that some radical step must be taken.

The product of this concern has been designed and developed with a view to low cost of manufacture combined with quality equal to or better than the best of its competitors. It was accordingly felt that this product would be profitable when the later inevitable competitive period of the washing machine business should be reached and that this situation warranted permanent factory investment.

A Well Developed Plan

It was accordingly decided in December, 1919, to build a new factory and general requirements or specifications were outlined as follows:

The new plant should be located in Syracuse with direct shipping facilities on more than one railroad, with reasonable accessibility to labor and with ample space for future growth not only of the business of manufacturing washing machines and other similar products but for later subsidiary or auxiliary industries.

The building should be of fireproof, permanent construction without unnecessary frills, well lighted both night and day and have 180,000 sq.ft. of space of which 30,000 sq.ft. should be available for office facilities. It should be a permanent part of a much larger factory and be adapted to considerable rearrangement with the growth of business and gradual transfer of certain activities to later building extensions.

Equipment should be installed to manufacture several times the daily capacity of the old factory with proper space equipment where necessary. There should be installed no "special purpose" equipment of limited use for other products, and expensive machine tools should pay for themselves within three years of normal use as compared with simpler and less expensive equipment. All jigs and fixtures should be designed to pay for themselves in six months as compared with devices already in use.

With these general specifications as a guide, arrangements were entered into with Ford, Bacon & Davis, acting in co-operation with company officials, to assist in determining the site, to design and construct the building, to specify, lay out and install ready for operation, all manufacturing equipment, and to supervise the selection, design and purchase of all jigs, tools and fixtures. In connection with the latter work, the Manufacturers' Consulting Engineers, of Syracuse, co-operated with Ford, Bacon & Davis.

The entire city of Syracuse was studied for location, and finally, some twenty-five acres of land were purchased near the Erie Barge Canal Terminal, the Rome, Watertown & Ogdensburg Division of the New York Central Railroad, and the Delaware, Lackawanna & Western Railroad, thus providing three direct methods for the receipt of materials and the shipment of finished products, and space enough for any possible future development. The location is within one-half mile of the business center of Syracuse and is the focus of transportation facilities in Syracuse both present and future. Plans are under way to make this territory, known as the "salt lands," the future industrial district of Syracuse, involving the construction of a loop railroad tying together the main line railroads and the barge canal with a freight station directly across the street from the site.

The location chosen is adjacent to those districts of Syracuse from which labor is largely drawn and accordingly there was no housing problem. The location of the site with respect to Syracuse and with respect to the proposed loop railroad and the barge canal are shown in Fig. 1.

Buildings to Meet All Conditions

It had been observed that in the manufacture of domestic appliances, a reasonably definite relationship existed between the amount of space required for the assembly and shipment of a given number of machines per day and the space utilized for the production of parts, storage of raw materials, finished parts, etc. The single-story building seemed to offer the greatest merit for the volume of production immediately to be planned for, and a building of the size chosen would fit in very satisfactorily with a connected multi-story building which could later be used for general manufacturing purposes, the single-story building then being utilized for the assembly and shipment of machines.

The relationship between the single- and multiple-story building, together with street and track levels is shown by Fig. 1, which indicates a complete development of one block of the site purchased.

In the complete development it was planned to have all incoming freight arrive on the upper tracks adjacent to the multi-story building and have all shipments made

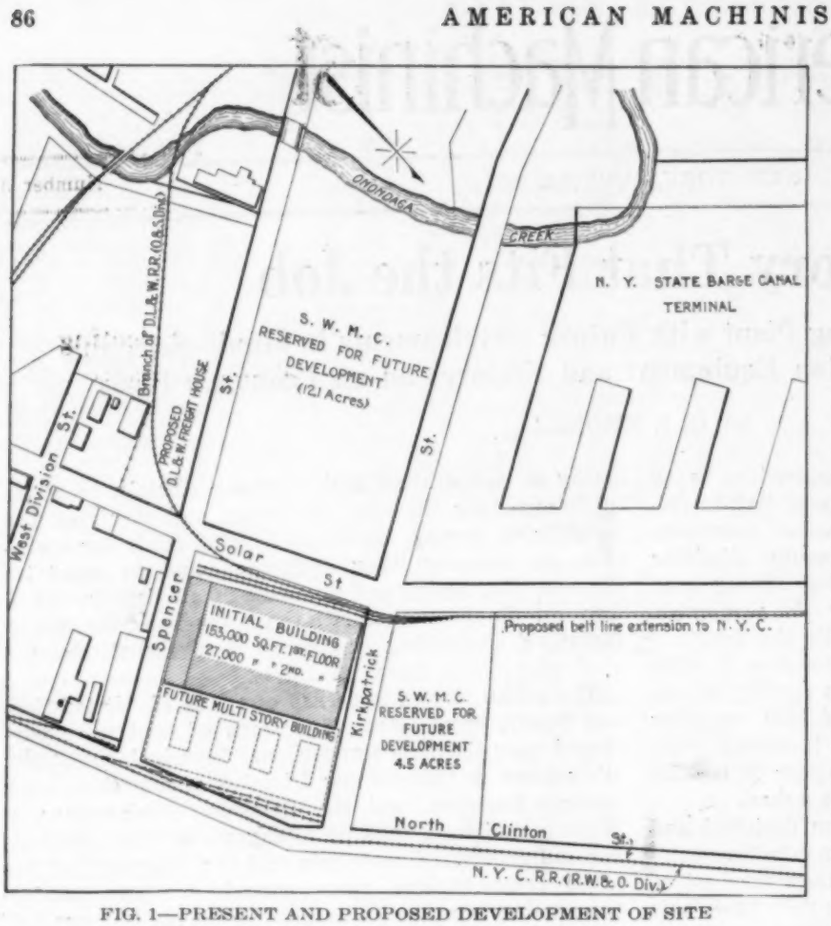

ONONDAGA
CREEK
N. Y. STATE BARGE CANAL TERMINAL
S. W. M. C. RESERVED FOR FUTURE DEVELOPMENT (12.) Acres)
Branch of D.L.&W.R.R. (O.A.S.Div.)
PROPOSED D.L.&W. FREIGHT HOUSE
West Division St.
Solar St
Spencer St.
INITIAL BUILDING 153,000 SQ.FT. 1st. FLOOR 27,000 " " 2ND. "
FUTURE MULTI STORY BUILDING
Kirkpatrick St.
S. W. M. C. RESERVED FOR FUTURE DEVELOPMENT 4.5 ACRES
Proposed belt line extension to N. Y. C.
North Clinton St.
N. Y. C. R.R. (R.W.&O. Div.)

FIG. 1—PRESENT AND PROPOSED DEVELOPMENT OF SITE

from the lower level tracks along the single-story building. It seemed probable that the output of the ultimate building would call for receipts and shipments aggregating approximately 200 cars per day and accordingly this segregation seemed absolutely necessary with a further simplification of internal transportation problems. With the initial construction of only the single-story portion of the building, the volume of receipts and shipments could very easily be handled on the low level tracks.

The single-story building was accordingly designed 300 x 420 ft. with a two-story building 300 x 90 ft. at the southerly end. The single-story building is of concrete and steel construction with saw-tooth roof and steel sash throughout; the two-story portion is of similar construction with a saw-tooth roof over the second-story office for better lighting facilities. Gypsum was chosen as a roof material on account of its lightness and its heat insulating qualities which offered large savings in the cost of heating plant and of coal. Five-ply tar and gravel roofing was installed as offering the best protection for a gypsum roof. The frame and walls of the building are supported on concrete piles but the ground floor is laid directly on filled land. It was planned to utilize the two-story building as an office and general storehouse and the single-story building for manufacturing and assembly purposes combined with stores of finished parts. Insurance regulations required separation of the two-story building from the one-story building by firewall and the division of the single-story building into two substantially equal parts by a wall of hollow tile or a construction of equivalent safety.

With the limitations as imposed by location of fire walls, careful study of the floor layout was made with a view to arranging storage, manufacturing, assembling, crating and shipping facilities in such a manner as to reduce to the absolute minimum the amount of internal transportation. In fact, transportation and the handling of materials was one of the prime considerations in the layout of the factory buildings.

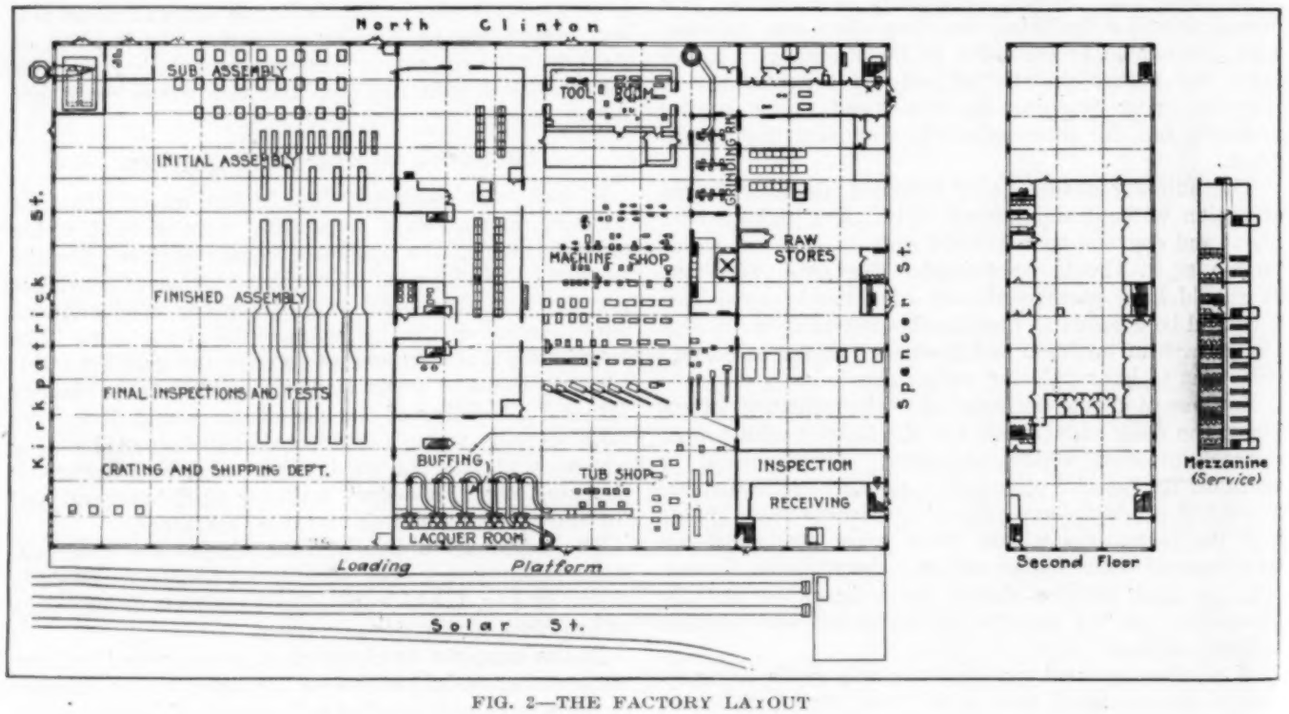


FIG. 2—THE FACTORY LAYOUT

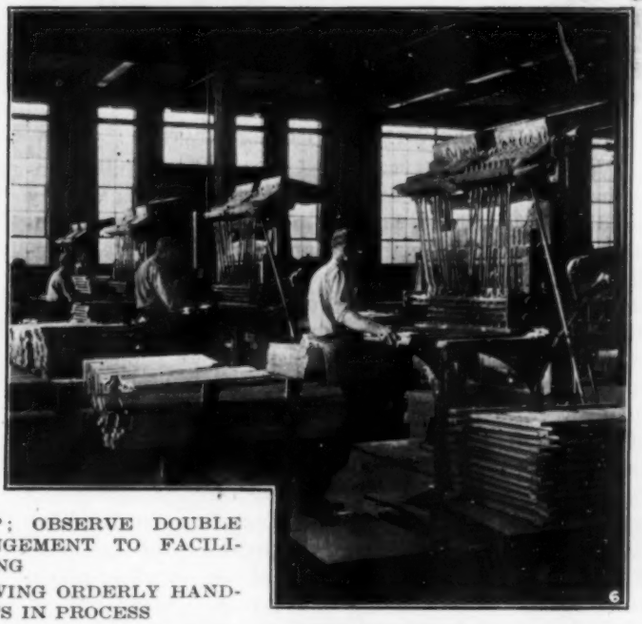


FIG. 3—MACHINE SHOP; OBSERVE DOUBLE AISLE ARRANGEMENT TO FACILITATE TRUCKING

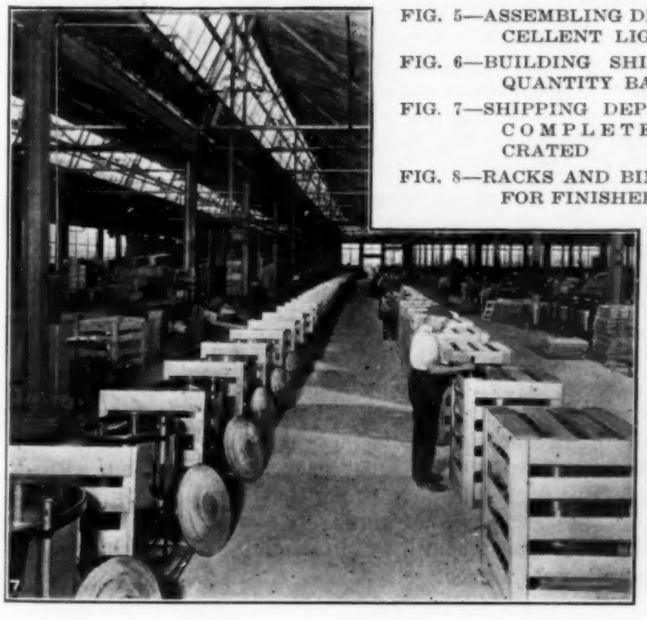
FIG. 4—TUB SHOP SHOWING ORDERLY HANDLING OF PARTS IN PROCESS

FIG. 5—ASSEMBLING DEPARTMENT; NOTE EXCELLENT LIGHTING CONDITIONS

FIG. 6—BUILDING SHIPPING CRATES ON A QUANTITY BASIS

FIG. 7—SHIPPING DEPARTMENT SHOWING COMPLETED MACHINES BEING CRATED

FIG. 8—RACKS AND BINS IN THE STOREROOM FOR FINISHED PARTS



The arrangement finally chosen is indicated by Fig. 2. The shipping and receiving platform which is ultimately to be covered by a canopy is parallel to two tracks. In general, material is received at the end of the siding where provision is also made for motor truck delivery of raw materials. These materials are inspected, weighed and passed into the storerooms, locations for the different classes of material being chosen adjacent to the operating department in which they are to be used. Practically all castings pass through the grinding room and are japanned before machining operations. Very few castings are later returned to the japanning room for further treatment. These castings then pass through the machine shop and are delivered to finished stores or to the assembly department as may be desired. All bars pass to the left through the machine shop and are either operated upon by punches and saws or by bar automatics. Some of these parts require other machine operations but a large portion of them pass directly to the finished storeroom or to the assembly department. The sheets pass to the left through the tub shop and tubs art delivered to the buffing department and thence by gravity conveyor into the lacquering room from which they are conveyed to the assembly. Throughout the entire arrangement, there is little necessity for doubling back of tractory transportation.

Inter-department Transportation

Types of factory transportation were carefully considered for the ultimate capacity of the single-story building, although it was not planned to make the installation of the ultimate equipment until business conditions brought the output of the plant to a volume materially larger than the output of the old plant. Storage battery tractors seemed to offer the best solution of the general factory transportation problem and accordingly all aisles, together with the shipping platform, were made sufficiently wide to allow two trains of tractors and trailers to pass each other at any point. In the case of tubs and covers, the bulk was too large for reasonable transportation by such means, and it was accordingly planned eventually to install an overhead tub conveyor. The tubs when fabricated in the tub shop would be hung on the conveyor and delivered to magazines located above the buffing jacks. After buffing, the tubs would be placed upon magazine gravity conveyors and delivered to the lacquering room. After lacquering the tubs would be hung from the conveyor which would carry them through a continuous drying oven and deliver them to overhead magazines located along the various assembly trains. It was planned in the complete plant, to use continuous assembly systems for sub-assemblies and the final assemblies of the machines but the working out of such systems was deferred until the production of the factory should warrant.

The washing machine as constructed in the old factory was thoroughly examined with a view to making such changes as would be desirable for production in larger quantities and a detail study was made of every individual operation entering into fabrication and assembly of the finished machine. The machine tool market was studied with a view to securing the best equipment in the quickest possible time and the machine tool manufacturers were given an opportunity to demonstrate the possibilities of their machines in the line of reducing costs. The capacities and operations of the various machines were carefully checked in detail and their applicability to best possible jigs and fixtures was carefully studied. Since delivery of all tools was required before July 1, 1921, limitations were placed upon the choice of machine tools, which made it impossible to secure all economies that were desired. The operation of every individual tool was carefully studied in its relation to the production expected from the equipment to be installed and no tool was purchased unless it would pay for itself within three years, as compared with methods of fabrication employed in the old factory. Automatic bar machines, gear cutters, etc., were installed, but in large measure the equipment was non-automatic and jigs and fixtures were provided for the various operations, with a view to eliminating to the greatest possible extent, all lost motion or waiting time on the part of the operator and all non-productive time on the part of the machine. Where the number of production parts warranted, multiple jigs were provided, of which the operator would be loading one section while the tool was working on the other half. Some of the jigs showed savings sufficient to pay for their entire cost in three months as compared with methods used in the old factory.

As a result of the operation of this new factory at considerably less than its capacity due to the depressed market for washing machines, it has been demonstrated that the actual savings in labor alone, should the new factory be operated at outputs no greater than the capacity of the old plant, would be more than sufficient to pay the full carrying charges of the entire new factory. The Syracuse Washing Machine Corporation is therefore provided with several times its old manufacturing capacity without additional annual cost.

Spiral or Helical?—Discussion

By Gus Haessler

The recent editorial on page 719, Vol. 56, of *American Machinist*, entitled "Spiral or Helical?" and emphasizing the need of the precise use of terms as applied in the machinery field, is a step in the right direction. Not only do handbooks, treatises and advertisers persist in using these terms interchangeably, but writers of the current literature from whom we might expect better deeds continue to do so. They even go further by coining other erroneous ones in spite of the fact that "Halsey's Handbook" proclaims in large type that helical gears are commonly miscalled spiral gears.

Gear teeth may be either straight or helical—then why should we not term them so? Why introduce a multiplicity of terms into the nomenclature that serve no well defined purpose other than to cause doubt? The path of those seeking accurate information along mechanical lines may be made smoother by doing away, as far as possible, with the use of synonyms in technical literature and substituting terms of restricted meaning.

Dictionaries may treat the terms helical and spiral in the abstract as having something in common, or as synonymous. On the other hand, in dealing with two different concrete objects there is need of specific terms, which to avoid error must be correctly applied. Progressive writers should prove that they are, by following the leadership of those endeavoring to distribute the greatest amount of information with the least possible resistance.

Automotive Service Methods and Equipment

XIV. Boring Fixture for Crankcase Bearings—Boring Connecting Rods in the Lathe—A Simple Cylinder Lap—Brazing a Cracked Manifold

By HOWARD CAMPBELL
Western Editor, *American Machinist*

THE descriptions and illustrations included in this article were obtained during a trip through the service department of the Sinclair Refining Co., at Chicago, Illinois.

The operation shown in Fig. 1 is that of boring the main bearings on a truck crankcase. The apparatus consists of the boring bar, together with the gears, drive pulley and belt, and three castings containing sets of jaws similar to those in a steadyrest. One of these castings can be seen at *A* in Fig. 2. The crankcase is placed in position on a stand consisting of the two sections *A* and *B*, Fig. 1, and the "steadyrests" are

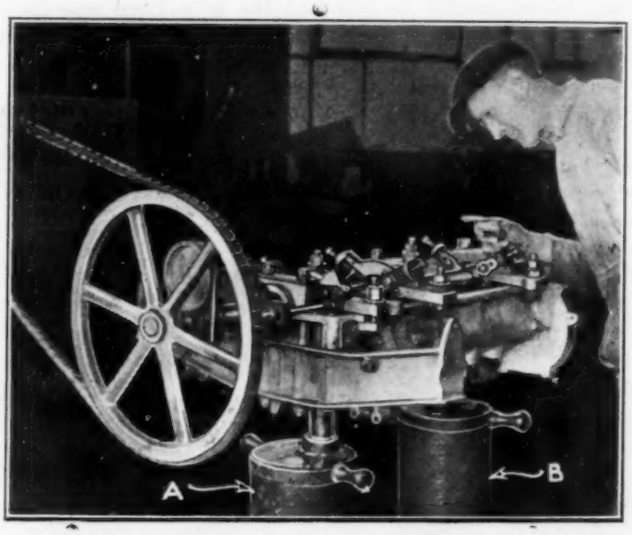


FIG. 1—BORING CRANKCASE MAIN BEARINGS

bolted to the case, the middle one as near to the center bearing as possible, and one just inside of each end bearing. Two bushings, each of which is a sliding fit on the boring bar and just large enough on the outside diameter to fit into the rough bearings, are slipped into place in the end bearings, and the bar is inserted. Then the steadyrest jaws are adjusted to the bar and the bushings are slipped out of the bearings again. The toolbits are now set with the aid of a micrometer, the gears are slipped into place, and the belt is put on.

The feeding mechanism can be seen in Fig. 2. The pulley, which is driven by belt from a motor, turns the pinion *B*, which is meshed with the gear *C*. Gear *C* is on the same shaft with pinion *D*, and this in turn drives the gear *E*, which turns the boring bar *F*. This bar is threaded for about 6 in. at the front end, as shown, as are also the jaws in the part *G*. Thus as the bar is revolved, it is also fed forward an amount equal to the lead of the thread. As the shaft is of steel and the jaws are made of bronze, the mechanism works very well. The piece *G* is hinged so that the two halves can be spread apart in order to locate the bar for boring. Toolbits are located in the bar at each bearing so that all three bearings are bored at the same time.

The Crankcase Stand

The stand on which the crankcase is located for boring is made of two sections of 8-in. pipe, threaded at one end and screwed into flanges which are bolted to the floor, as shown in Fig. 3. The piece *A* is a block of wood that has been turned to a sliding fit in the pipe, except for about 1¼ in., which being turned to the same diameter as the outside diameter of the pipe, serves as a flange or support for the block. A hole is bored through the block to receive the shaft *B*, which is about 6 in. longer than the block, and the collar *C* is slipped over the shaft to support it at the desired height. A slotted forging is welded or forged to the upper end of the shaft, to which the crankcase is bolted. Wooden handles are driven into opposite sides of the block so that the blocks can be turned and the space between the shafts varied with the design of the crankcase.

A unique type of crankshaft turning tool is shown in Fig. 4. This is a commercial article, made by Peters, Inc., Philadelphia, Pa. The operator shown in the illustration is holding the tool steady while the shaft revolves, but the real feature of this tool is that it can be used to turn the pins on a crankshaft without the use of a machine tool. In fact, the shaft need not be removed from the motor, in emergency cases.

The tool consists of an adjustable screw plate containing eight cutters, the whole thing being inclosed in an aluminum housing approximately 1¼ in. wide and 9 in. in diameter. The housing is made in two parts which are hinged together so that the tool can be opened and placed in position around the crankshaft pin. Then the screw plate is set so that the cutters rest on the crankpin, which is done by turning the screw plate with a

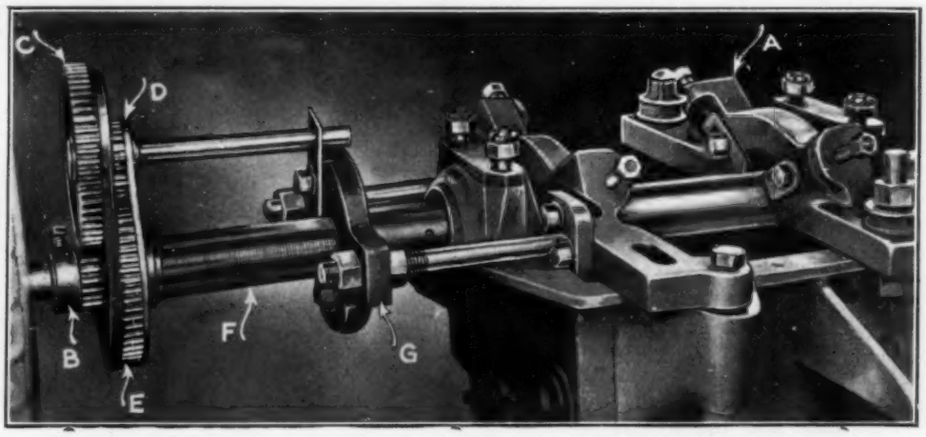


FIG. 2—MECHANISM OF BORING FIXTURE SHOWING METHODS OF DRIVING AND FEEDING BORING BAR

FIG. 3—STAND FOR HOLDING CRANKCASE

the fixture may be aligned quickly, two dowel holes are drilled in the cross-slide and corresponding pins are inserted in the bottom of the fixture. The small end of the rod, which is uppermost, is held in position by means of a wristpin which is inserted part way into the wristpin hole and partly into a collet chuck which is drawn into the piece *A* by the action of the nut *B*. The tightening of this nut also clamps the piece firmly in the slot. The slot is provided so that the various lengths of rods can be accommodated. The collar *C* is step-counterbored to accommodate the large ends of the various rods. The large end of the rod is held firmly in the fixture by the plate *D*, which is drawn against the piece by means of two screws with knurled nuts, as shown at E. The boring tool consists of a stub arbor carrying a toolbit, which is held in place by the usual headless setscrew. The stub arbor is turned to the same taper as the taper in the spindle.

No Scraping on Connecting Rods

No scraping is done on the connecting rods; they are bored exactly to size and the only hand operation is that of relieving the sides. The operator shown in

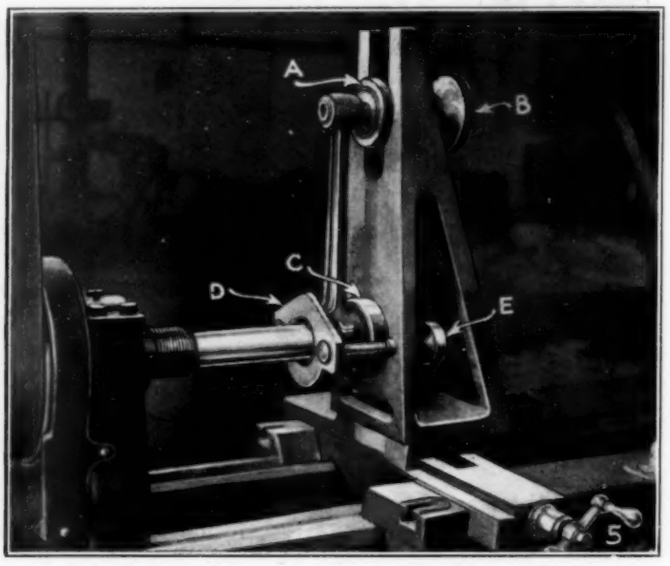


FIG. 4—TURNING CRANKSHAFT WRISTPINS. FIG. 5—BORING LARGE END OF CONNECTING ROD

spanner wrench. The turning of this plate moves all the cutters to or from the center universally. When the cutters are set, the tool is revolved by hand, the cutters gradually being closed in until the high spots are taken off or the desired size is obtained. After the tools have once been set, all pins can be turned to the same diameter, if desired.

After the crankshaft has been turned to the "clean-up" size, the fixture shown in Fig. 5 is set up on the lathe and the connecting-rod bearings are bored out. The compound rest is removed from the cross-slide and the fixture is bolted in place. In order that

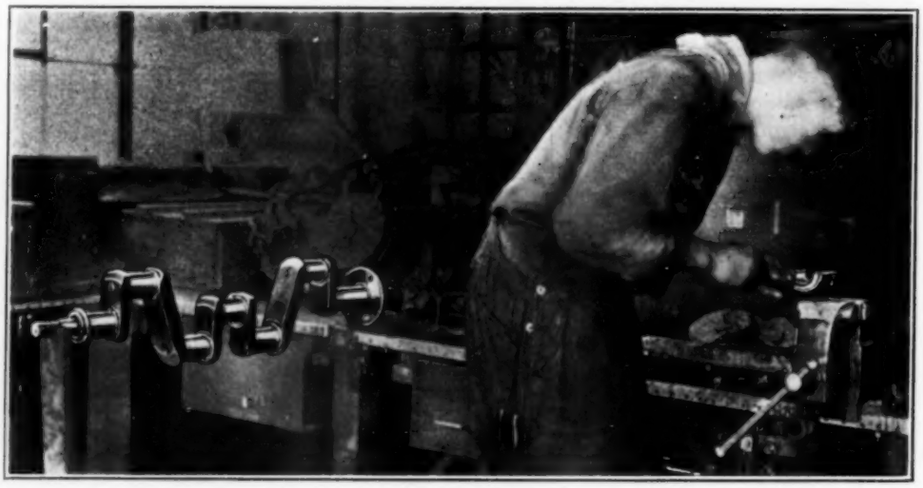


FIG. 6—RELIEVING CONNECTING ROD BEFORE ASSEMBLING; ROD HELD IN SPECIAL FIXTURE

Fig. 6 is performing this operation on one of the rod caps. The manner of holding the crankshaft for this operation is very simple. Two holes are drilled in a small section of angle steel, the holes being of the same size and the same distance apart as the holes in the flange end of the crankshaft. Then the steel section is bolted to the work bench in the position shown in the illustration, where it is left permanently. The shaft that is to be worked on is bolted to the angle and the other end of the shaft is rested in a notch in the end of a small board.

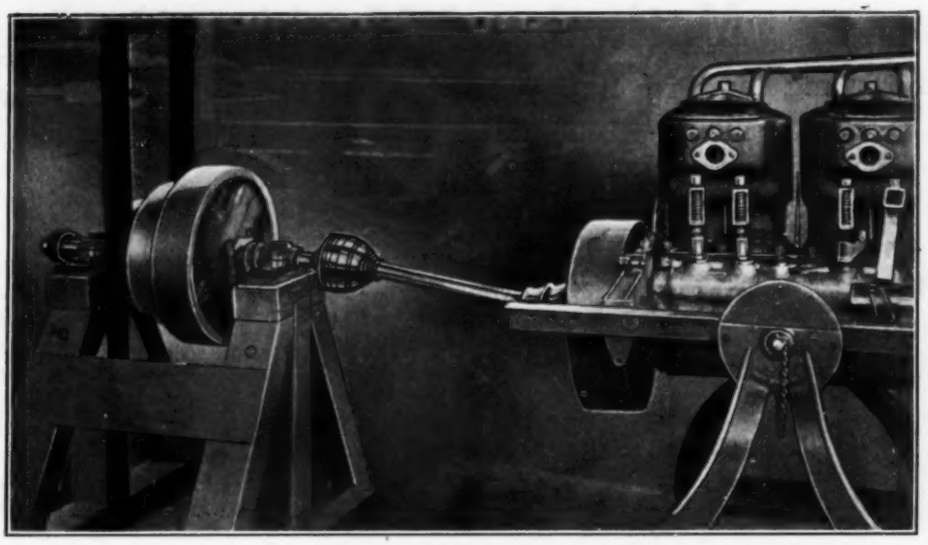


FIG. 10—"HOME-MADE" RUNNING-IN STAND

The operator shown in Fig. 7 is lapping out a cylinder with a home-made lap made out of an old piston. The piston, which can be seen in Fig. 8, is bored through the head so that the handle can be inserted. Then the piston is slotted the length of one side so that it can be expanded, and both wristpin holes are solidly plugged. One of these plugs is now drilled out to 1 in. diameter and threaded 14 threads to the inch. A headless screw is inserted in the threaded plug and screwed against the solid plug in the opposite side of the piston. A slight turn will expand the piston, which makes it possible to use it in many places instead of a solid piston.

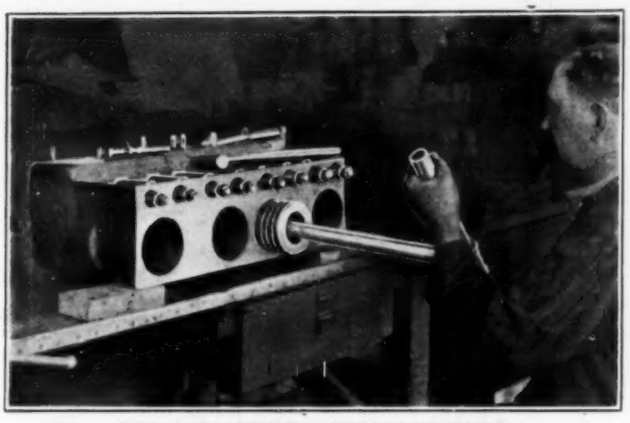


FIG. 7—LAPPING A CYLINDER BORE

The value of the gas torch in motor repair work is becoming more evident every day. Previous articles in this series described the use of the torch for brazing scores in cylinders, for filling worn clevis pin holes with bronze so that new bearings could be drilled and reamed in the solid metal, and for cutting off frames. Another illustration of the use of the torch is given in Fig. 9, where an operator is shown brazing a crack in a Packard truck manifold. According to the operator, a better job is obtained by brazing than by welding, because not only does the piece have to be preheated before welding, but a weld is much more liable to crack again than if the crack is brazed full of metal. For brazing no pre-heating is necessary. The metal used is a brass rod, $\frac{1}{8}$ in. in diameter for small cracks, but up to $\frac{3}{16}$ in. in diameter for larger ones. When ready to proceed with the operation, the operator dips the end of the rod into the flux, which aids in the amalgamation of the brass with the iron.

FIG. 8—PISTON USED FOR LAPPING

FIG. 9—BRAZING A CRACKED MANIFOLD

After a motor has been overhauled it is given a running-in test on the stand shown in Fig. 10. The stand is built of heavy timbers, and the three-step pulley, shaft and bearings are commercial materials that can be purchased from any supply house. An old universal joint is used to connect the motor with the pulley, and power is supplied from the line shaft. While it is usually safe to assume that an overhauled motor will run satisfactorily there is nothing like knowing positively that it has been turned over long enough to get the oil flowing through the bearings, and to know it is all right.

Methods of Machine Tool Design

Beginning Part Five on Gear Drives—Arrangements of Drive and Feed Gears on Lathes, Milling Machines, Boring Mills and Drilling Machines—Efficiencies

BY A. L. DELEEUW
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ONLY the smaller and simpler kinds of machine tools have a belt drive pure and simple. Practically all larger machines and even a large percentage of the smaller ones have some gears in the driving system. When we say that a machine is "belt driven" we refer to the source of power of that machine in order to distinguish it from a motor or engine drive.

Not only are gears used in the drives of most machine tools, but they are used also in feed mechanism and quite often in the system of control. We have, then, three systems of gear drives to consider—those used for the drive, those used for feed and those for control.

Whether gears are used for feeds or for speeds, we must consider carefully the elements of power to be transmitted and the speeds to be obtained. The amount of power of machine tools varies widely and is principally dependent on the size of cut we wish to take. We say "principally" dependent, because the nature of the tool also has a large effect on the amount of power required. For instance, it requires more power to remove a given amount of metal by a milling machine than by a planer. Similarly, it requires more power to remove a given amount of metal by drilling than by turning.

The exact calculation of the amount of power required for a given machine tool can never be carried out with any high degree of accuracy. The condition of the tool, the shape of the chip, the characteristics of the metal to be cut, etc., vary so largely that it would never be safe to guarantee a machine tool to be able to take a cut of given dimensions. It is this fact which has led to much misrepresentation and misunderstanding as to the capacity of a machine tool. However, there is no reason why a standardized cut cannot be established as a unit of measure for the determination of the capacity of a given type of machine tool.

Let us take as an example a planer, and let us say that the standardized cut would be taken with a tool of given shape and angles and in a slab of steel of given analysis, strength and hardness. Such tools and such slabs of steel could be furnished just as gages are furnished at the present time, and some disinterested institution—such as, for instance, the Bureau of Standards—could check up the qualities of the standard tool and the standard material. Having these two items, standard tool and standard material, it would then be possible to state that a machine has a capacity of a cut of so-and-so much at a speed of so-many feet per minute. If this were done, there would be very little chance for misrepresentation or misunderstanding.

To drop our dream and come back to realities again, we have to follow an entirely different line of procedure at the present time. Not being able to say how many cubic inches of metal can be removed and consequently being unable to say what the maximum pressure on the tool point will be, we must guess at the drive, and after having guessed, we must then construct our machine so that every element shall be strong enough to resist whatever strains this amount of power may impose on the machine.

For the author's forthcoming book. All rights reserved.

Generally speaking, part of the power supplied to the machine is used for the drive and part for the feed. Notable exceptions to this rule are the machines of the planer type; planers, shapers, slotters, gear shapers, etc. In these machines the feed takes place when the tool is out of the cut so that all of the power supplied is available for either the drive or the feed.

In order to proportion the mechanism of a machine tool it will be necessary to determine what portion of the total power supply is needed for the feed. Besides, it will be necessary to determine beforehand at what point in the mechanism feed and drive part company. To illustrate what is meant by this latter problem, let us consider a lathe. In practically all cases the feed of a lathe is taken off the rear end of the spindle, so that all gears, shafts, etc., between the driving source (motor or single pulley or cone pulley) and the rear end of the spindle must be proportioned so that they can take care of both drive and feed, while all similar parts coming after the rear end of the spindle need to take care of the feed only. This case is represented by Fig. 65.

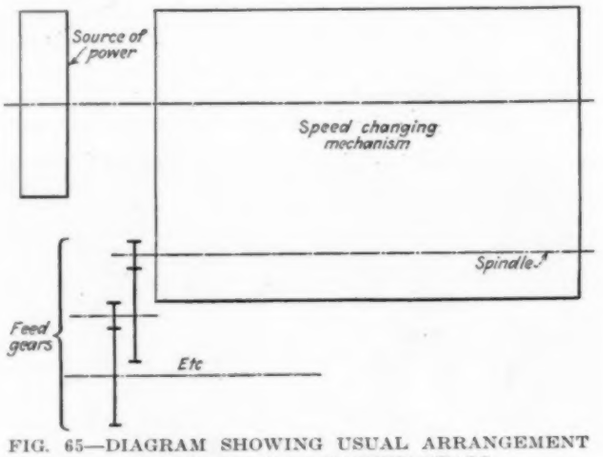


FIG. 65—DIAGRAM SHOWING USUAL ARRANGEMENT OF LATHE DRIVE AND FEED GEARS

On the other hand, a milling machine so arranged that the feeds are given in inches per minute presents a different problem. Here the feed is taken off a constant speed shaft, and all gears between this point and the spindle must take care of the drive and the drive only, while all gears on the other branch must be proportioned for the feed only. This case is illustrated by Fig. 66.

A third case, though essentially similar to the first one, is illustrated by Fig. 67. In this case, the feed is given in fractions of an inch per revolution. The machine represented here is supposed to be a large boring mill. In such a machine the speed changing mechanism is early in the train of gears and after

this there is a further reduction of speed. The reason why such a construction is followed is rather obvious. In a case of this kind the feed is taken off the first shaft of which the speed bears a constant relation to the speed of the spindle. In the case represented by Fig. 65, all gears of the drive had to be of sufficient size to transmit all of the power for drive and for feed; but in the third case, the last gears of the system needed only sufficient strength for the drive, as the feed

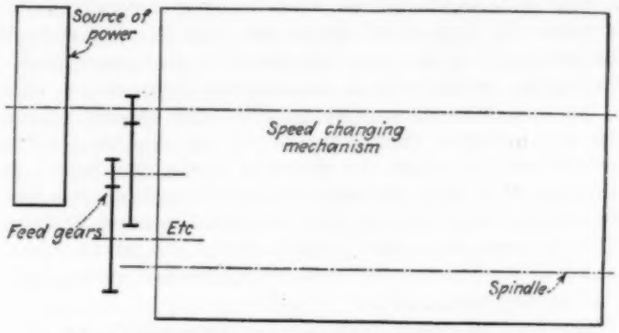


FIG. 66—DIAGRAM SHOWING ARRANGEMENT OF MILLING MACHINE GEARING

had already been branched off before this point was reached.

It is often difficult to state what portion of the total power is required for the feed only. On the other hand, as we must proportion gears, shafts, etc., for the greatest load which they may have to bear, we need to be interested only in the amount of this greatest load. This load is imposed when we take the heaviest roughing cuts in the case of lathes and similar machines. It has been found by practical experimentation that, for heavy cuts and using a round nosed tool (which is the tool used for such cuts in the majority of cases), the amount of pressure of the chip on the tool is about equal to the amount of side pressure required to make the tool feed into the work; so that, if we know what cuts we can take and what the pressures are which are caused by such cuts, we will have the necessary data for the proportioning of the feed parts.

Though such data are not known with a high degree of accuracy, yet we know enough to determine the maximum feed pressures with a fair degree of safety.

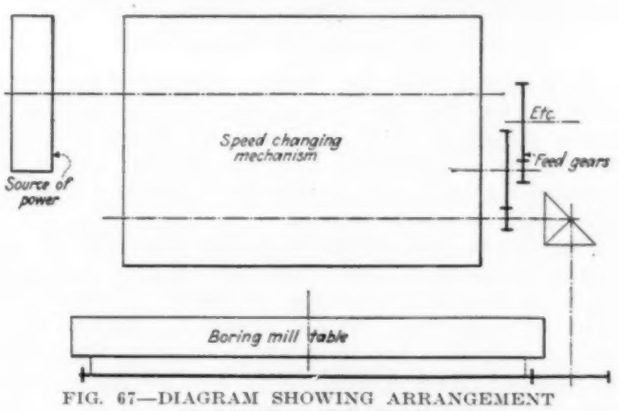


FIG. 67—DIAGRAM SHOWING ARRANGEMENT OF BORING MILL GEARS

If, for instance, a certain lathe must be constructed to take a cut in mild steel $\frac{1}{2}$ in. deep and with $\frac{1}{4}$-in. feed, then we know that the pressure of the tool will be in the neighborhood of $\frac{1}{2} \times \frac{1}{4} \times 240{,}000 = 30{,}000$ lb., and this would be the amount of feed pressure we may expect with a round-nosed tool.

If the mechanism for drive and feed were 100 per cent efficient, then the total amount of power which must be set apart for the feed would be very small. Assuming that the cutting speed is 45 ft. per minute and that we are turning up a 6-in. shaft which makes approximately 30 r.p.m., so that the feed would be $30 \times \frac{1}{4} = 7\frac{1}{2}$ in. per minute, then we would find that the drive (running at 45 ft. = 540 in. per minute) requires 72 times as much power as the feed which runs at $7\frac{1}{2}$ in. only. Under such ideal conditions the feed would take less than $1\frac{1}{2}$ per cent of the total power of the machine.

Efficiency of Lathe Feed Mechanism

However, the efficiency of practically any feed mechanism is very low. In the first place, a great number of gears and shafts are, as a rule, required to transmit the power from the starting point to the point where it is applied to carriage or toolholder. In the second place, in the majority of cases, there is a screw employed somewhere in the mechanism, and generally at the final point of the feed train, and such a transmission of power by screw has a very low efficiency. As a consequence, it would not do to base the proportions of the various parts of the feed mechanism on the theoretical amount of power required for the feed. Rather must it be based on the pressure against the tool point. In other words, proportioning the elements of the feed train, we must start at the tool point and work backward. We must not forget that there are other resistances to overcome besides the resistances of the metal against the edge of the tool. Toolholders, carriages, etc., are tightly gibbed to their supporting members. This is absolutely necessary in machine tool construction so as to avoid all unnecessary looseness and resulting vibration and inaccuracy. The power required to move such a tightly gibbed member may be quite an appreciable percentage of that required to feed into the metal. Finally, the point of application of the feed mechanism to a toolholder or carriage is very often out of center, thus tending to twist the toolholder, or, as it is commonly called, to "cock" it against its ways, and this may, under unfavorable conditions, cause a great deal of extra resistance.

It will be seen, then, that even with such a simple and well-known machine as a lathe, it is not quite possible to estimate with any degree of certainty what percentage of the total power must be used for the feed, and it therefore becomes necessary to make ample allowance over and above the best possible estimate which can be made.

In the case of a milling machine, we again have the condition that the pressure of the cut is approximately the same as the pressure required for the feed. If the teeth of the cutter were always working in a horizontal plane, then the feed pressure would be the same as the cutting pressure. This condition is modified by the fact that the tooth of the milling cutter describes an arc and that therefore the pressure of the cutter against the work, measured in a horizonal direction, changes from point to point. Besides, the chip does not have the same thickness at various points. As the cutter tooth starts to work it takes a chip of infinitesimal thickness, but this thickness gradually increases and with it the required feed pressure. The feed mechanism of a milling machine, therefore, is not subject to an even

load but changes continually from a minimum to a maximum. This amount of variation is less when more than one tooth is in the work, and is still further reduced if a spiral or helical cutter is used.

Actual experiments have shown that the efficiency of the feed mechanism of existing milling machines, though widely varying, is always very low. The highest efficiency obtained in a series of tests was 20 per cent, the lowest efficiency less than 2 per cent. In another series of tests, and with older types of milling machines, it was found that with a cut requiring a total of 10 hp., as much as 3½ hp., and in one case even 4 hp. was required for the feed. It is possible, however, to construct the feed mechanism in such a way that a maximum of 20 per cent of the total power supplied will take care of the feed for the heaviest cuts which may be taken. With lighter cuts a larger percentage may be used for the feed, but, as the total power required under these conditions is less than with the heavier cuts, those less favorable proportions do not need to be considered.

Extremely Heavy Feed Pressures Applied Hydraulically

Feed pressures have been used in actual practice up to 300,000 lb. To the writer's knowledge no machine tools have been constructed employing strictly mechanical means, such as gears and shafts and screws, for the application of these extreme feed pressures. Where such pressures were required, hydraulic feeds were applied. On the other hand, feed pressures as high as 200,000 lb. have actually been transmitted by means of long feed screws.

In the case of boring mills of large size, heavy cuts may be taken requiring heavy feed pressures. In addition, the construction of a boring mill makes it necessary to use long shafts and many gears for the purpose of reducing and controlling feeds and for the purpose of going around the many angles and corners that lie between the toolholder and the point where the feed branches off from the main drive. As a result, the amount of power required for the feed of a boring mill is greater than that required for the ordinary lathe.

As a broad proposition it may be said that the amount of power which should be set aside for the feed of a lathe, a boring mill or a milling machine, is proportional to the size of cut taken; or better still, proportional to the amount of metal removed per minute. This rule does not apply to drilling machines. In such machines the feed pressure is only partly dependent on the size of the cut, and very largely dependent on the nature of the tool used.

Considerations Affecting Drilling-Machine Feeds

A 1-in. twist drill removes an amount of metal of which the cross-section has an area of about ¾ sq.in. This same area would be removed if a 1-in. hole were counterbored to 1½ in., but the feed pressure required for this latter operation would be very much less than that required for the drilling of the 1-in. hole. This is due to the fact that not all of the metal is removed by the action of cutting when a twist drill is used. The central web must penetrate into the metal by sheer compression or crushing. If we picture the action of a twist drill as if it consisted of two separate actions —in the first place, that of penetrating into the metal an amount equal to the feed per revolution; in the second place, the removal of this metal by turning the drill—we will see that the metal lying under the central web must be pushed away in order to permit this penetration. There is a popular conception of this action to the effect that the central web crushes the metal into fine particles which are removed with the other chips. This picture is not correct. The metal is not crushed into fine particles, but is pushed sideways into the surrounding metal, and part of that surrounding metal is lifted up. The action is the same as that of a center punch when making a punch mark. A crater is formed of which the rim is composed of the metal which has been displaced by the punch point. The action of the central web may be compared to that of an operation of embossing. We can readily reason out for ourselves that it would not be possible for the central web to crush the material into a fine dust. If this were the case, we might make a punch shaped like the central web, force it into the metal, remove it, blow out the dust that was formed, force the punch somewhat further, and so on until we finally had made a hole of the required depth.

The feed pressure required for the penetration of a twist drill into a piece of work consists then of two items: (1) The pressure required to make the cutting lips feed into the work; (2) the pressure required to cause the central web to displace the metal underneath.

The first item depends on the size of the drill, the amount of the feed, the hardness of the material to be drilled, and the sharpness of the tool. In other words, it follows much the same laws as the feed pressure required in other cutting operations. The second item, the pressure required to make the central web penetrate into the metal or crush the metal, also depends on the nature of the metal to be crushed, and besides, on the area of the central web and the angle to which it is ground. A flat angle will have a tendency to press the metal downward rather than sideways. A pointed cone will press the metal sideways and allow it to get out of the way without excessive pressure. This is the reason why a pointed drill is used where the breaking through of the drill might cause serious trouble. The amount of pressure required for this punching action of the central web is, at the present, not known. It is, however, well known that it is a very large percentage of the total pressure required.

Prefers Forced Lubrication

By Frank W. Wearin

Both forced feed and splash lubrication are good systems, but the first is the better as it supplies a steady stream of oil to each bearing. With the splash system the oil gets dirty very quickly, and should be changed regularly as it is difficult to provide a filtering system that would be suitable.

The forced feed system is by far superior, but, as the editor remarks, there should be a proper system of filtration that will clean the oil before it enters the pump on each cycle. The oil should be changed regularly though it is not necessary to do so as frequently as with the splash system. With clean oil the bearings will very rarely score, and never on account of the oil, if it is of good quality.

My experience has been on steam turbines and machine tools. The oil reservoir is invariably too small on the latter. Of course there are limitations to size, but the larger the reservoir the slower the filtration and the purer the oil.

The Machining of Camshafts

Use of Multiple Tools in Turning Camshafts—Master Cams and Cam Grinding Methods—Uniform Centers a Necessity—A Flush Pin Gage

BY FRED H. COLVIN
Editor, *American Machinist*

THE machining of camshafts for automobile motors is generally done by rough-turning the bearings and straight portions between the cams, the rest of the work being done by grinding. In some few places the cams are first milled with small cutters to approximately the desired shape and in one or two instances special machines have been designed for turning the cams ready to be finished by grinding. The general practice, however, is to grind the cams from the forgings without previous machining of any kind.

The individual cam of the earlier designed motors has given way to the cam forged integrally with the camshaft and machined as previously indicated.

In plants where a large production is necessary, multiple tooling is resorted to in order to economically machine numerous straight portions between the cams. In some cases these multiple tools are arranged in a special

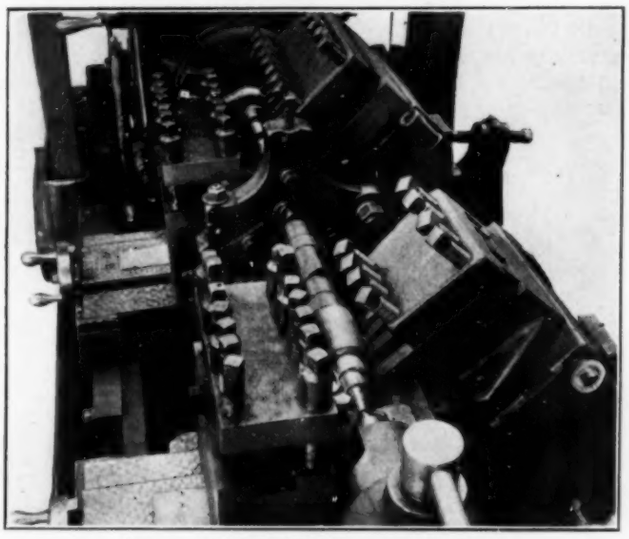


FIG. 1—FIRST TURNING OPERATION

toolblock on a standard engine lathe, but large production usually requires special machines such as the Fay automatic or the Lo-Swing. The tooling arrangement on the Fay lathe can be seen in Figs. 1, 2, 3 and 4. Figs. 1 and 3 show the lathes themselves with the work in place, while Figs. 2 and 4 are the tool diagrams which show clearly the number of tools employed and explain how the camshaft can be so quickly machined. Referring to Fig. 2 it will be seen that the tools in group *A* face down between the cams and the bearings, while those at *B* automatically feed into the work, traverse it in the direction of the arrow shown and automatically feed out of the work. The tools in group *C* feed in and cut the four shoulders shown, while those in block *D* turn the small diameters at the end of the shaft. The remainder of the camshaft is turned at a second operation, which is shown in Figs. 3 and 4 and requires no explanation.

In this particular shop the first operation is to mill the ends of the camshaft to lengths, as shown in Fig. 5, locating it by means of the gage at *A* so as to have the cams and bearings come in their proper position. The camshaft is centered as shown in Fig. 6, utilizing a quick acting clamp and having the workrests firmly against the stop so as to insure uniform center depth. The correctness of the centering has a marked effect on the production as a shallow center in one end and a deep one in the

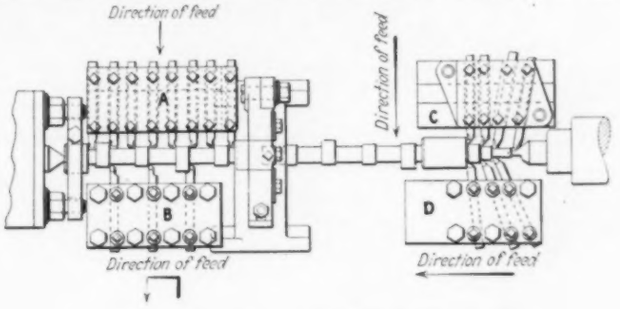


FIG. 2—THE TOOL LAYOUT USED

other shifts the camshaft endwise and affects the turning operation. In order to insure this uniformity the minimum and maximum gage shown in Fig. 7 is used.

The three large-diameter bearings are next rough-turned or ground to within 0.003 to 0.005 in. to furnish driving and back resting surfaces for future operations. Then comes the turning which has already been shown, leaving the camshaft ready for heat-treating, oil grooving and the finish-grinding of both the bearings and the cams themselves. It is interesting to note that in the turning operation there are eighteen tools at work simultaneously.

The other method of machining referred to is illustrated in Figs. 8 and 9, which show another design of camshaft. The sequence of operation is approximately the same and the arrangement of the tools can be very

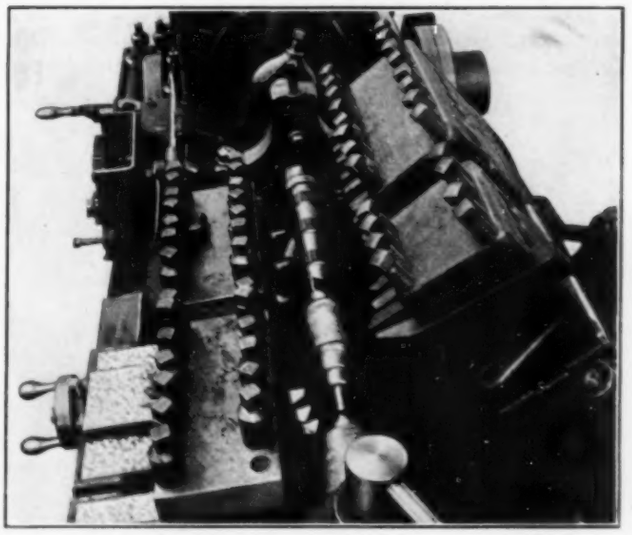


FIG. 3—TURNING THE OTHER END

easily studied from these two illustrations. These illustrations show a camshaft for a six-cylinder motor and consequently the use of a greater number of tools is possible.

After the turning operations, no matter how they are

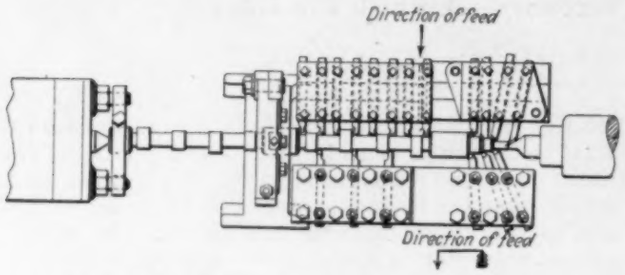


FIG. 4—TOOL LAYOUT FOR SECOND OPERATION

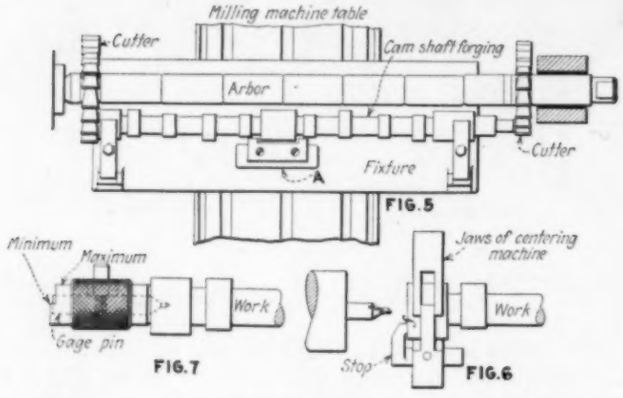


FIG. 5—CUTTING OFF SHAFT ENDS. FIG. 6—CENTERING THE SHAFT. FIG. 7—GAGING THE CENTER

performed, camshafts are ready for heat-treating or carburizing, or both, as the case may be.

As the cams themselves are usually ground from the rough forging, it is necessary to remove considerable material at a fairly rapid rate, and at the same time to preserve accuracy so as not to leave too much material for the finishing wheel. Probably no other common grinding operation calls for such fine workmanship and accuracy as the grinding of cams. It is a case where the art of grinding must be known and practiced continually in order to give satisfactory results.

The makers of wheels and grinding machines usually recommend the 24-R. Alundum wheel, or its equivalent, for roughing. The general practice of automobile shops,

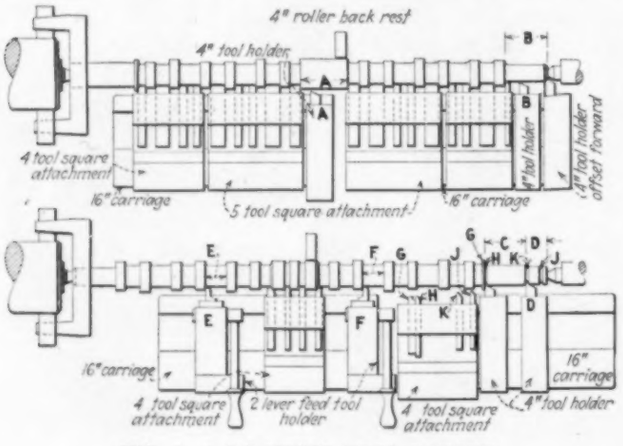


FIG. 8—A LO-SWING TOOL LAYOUT

however, is to use a considerably harder wheel as a means of securing a higher output per machine. This seems to prove satisfactory and it is usually very difficult for the demonstrator to secure any change in this practice.

Finish grinding of cams is usually divided into two operations, the first, removing the scale due to case-hardening or heat-treatment. The wheels used are usually of the J or K grade, either No. 46 or a No. 24 combination. While some shops make two entirely sepahate operations of the finish grinding, in most cases the camshaft is not removed from the grinding machine but the wheel is dressed and the finishing touch taken.

In the plant of the Hudson Motor Car Company, for instance, a 24-R. or a 24-S. wheel is used for rough-grinding. This removes from 0.25 to 0.275 in. from the rough forging. In the finish-grinding, wheels of No. 24 combintion K and No. 46, J or K are used, the latter being standard in the above plant. In the rough-grinding, the production is from 60 to 70 camshafts in 8½ hours, and in finishing from 55 to 60 camshafts in the same time.

In the same plant, production of the Essex camshaft (which, of course, is for a four-cylinder motor) is from 75 to 80 camshafts in the rough-grinding, and about the same number in the finishing operation. This production has, we understand, been materially increased by the application of vertical wheel-slide stops.

In large plants wheels No. 30-R. are used for rough-grinding and No. 24 combination K for finishing. The production is from eleven to twelve shafts per hour for

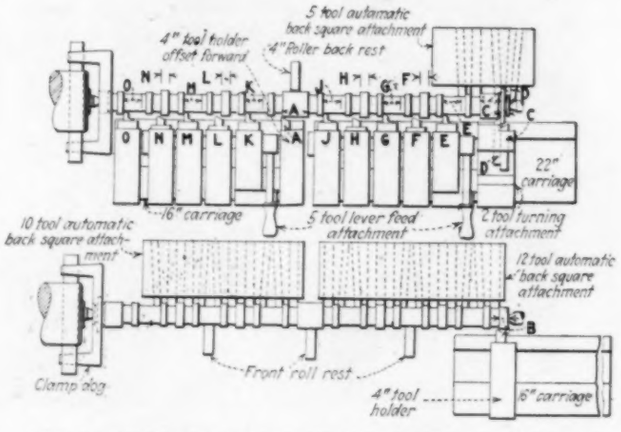
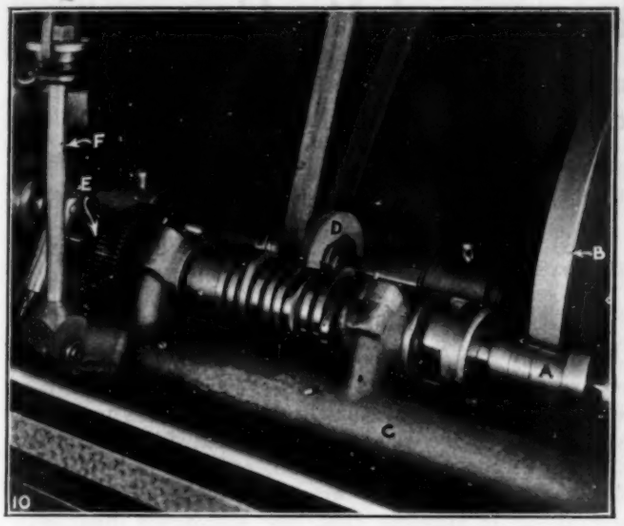

5 tool automatic back square attachment
4" tool holder offset forward
4" roller back rest
O N M L K A J H G F E D C
22" carriage
16" carriage
5 tool lever feed attachment
2 tool turning attachment
10 tool automatic back square attachment
12 tool automatic back square attachment
B
Front roll rest
Clamp dog
4" tool holder
6" carriage

FIG. 9—ANOTHER EXAMPLE OF LO-SWING TOOLING

rough-grinding and about eleven per hour for the finish-grinding. The finish-grinding is in two operations, removing 0.03 in. The operator takes his first cut over 100 camshafts, trues his wheel and goes over them a second time, producing 100 finished camshafts in nine hours. A wheel speed of 6,500 circumferential feet per minute is advocated although there is a tendency in some quarters to reduce this appreciably, sometimes as much as 1,000 ft. per minute. When it comes to the best work speed, there is a wide range of opinion, and it is here that the operator can utilize his experience to the best advantage in order to secure the desired finish without reducing the output. For roughing, the work speed is not so important and the camshaft can be run moderately fast, say from 40 to 60 r.p.m.

For finishing, however, a considerably lower work speed should be used, from 16 to 20 r.p.m. being found satisfactory in most cases. The best speed, however, must be



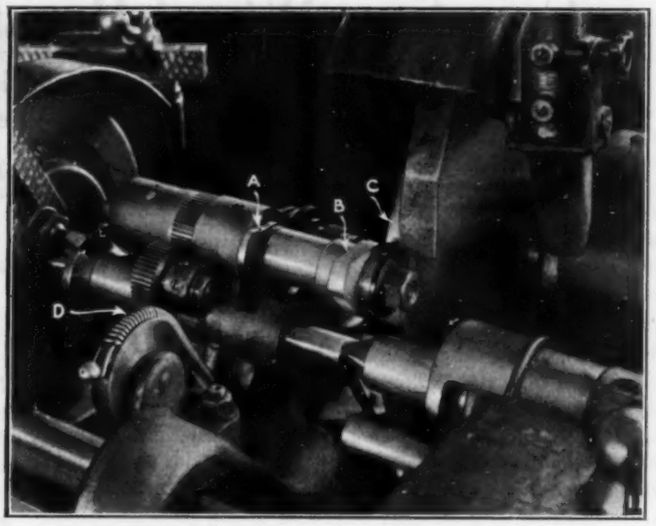


FIG. 10—GRINDING MASTER CAMS. FIG. 11—GRINDING A SINGLE MASTER CAM

determined in each individual case by actual experience, as much depends on the shape of the cams, especially of the lift portion. The finish required and the wheel used also have a marked effect. In one particular instance, it became necessary to reduce the speed to 5 r.p.m. in order to eliminate the chatter. In order to thoroughly lubricate the work and carry away the heat, a large supply of grinding solution or compound should flow directly on the work at the point of wheel contact at all times during the grinding operation, helping to keep the work at uniform temperature and tending to insure thorough lubrication and accurate grinding. This is important if an accurate camshaft is required, as excessive heating distorts the shaft and often causes checks in the cam faces. Any good commercial compound or soda water and lard oil can be used.

In finishing camshafts, it is very important to keep the wheel true and it should be dressed very frequently. Unless this is done, it is impossible to secure satisfactory results.

It is also necessary to pay careful attention to the steadyrests and to be sure they are securely fastened in place. The work shoes must have a good bearing surface on the camshaft in order to hold it as they should. It is also advisable to be very sure that the camshaft attachment is firmly fastened to the table, and that the attachment has been wiped very clean before putting in place.

The centers in camshafts should be as large as is consistent with the size of the shaft and as perfect as possible. The centers should be kept clean and well oiled; but do not put oil on the master cams or on the roll surface, as dust collects rapidly and may result in inaccurate work.

Attachments for grinding master cams are shown in Figs. 10 and 11. Fig. 10 shows all the master cams mounted on the single shaft, while in Fig. 11 a single cam is being ground at *A*. The master cams are shown at *A*, Fig. 10, making contact with the large disk *B* by which the cradle *C* carrying the cam to be ground is moved to and from the grinding wheel *D*. The gearing by which the cams are driven is plainly shown at *E*. The rod *F* leads to a counterweight which always keeps the master cam in contact with the large disk.

A somewhat different arrangement is shown in Fig. 11 where the cam being ground is shown at *A*, the master cam at *B*, the large disk at *C*. Instead of an overhead counterweight, the cradle is controlled by the spring *D*, keeping the master cam always in contact with the large disk.

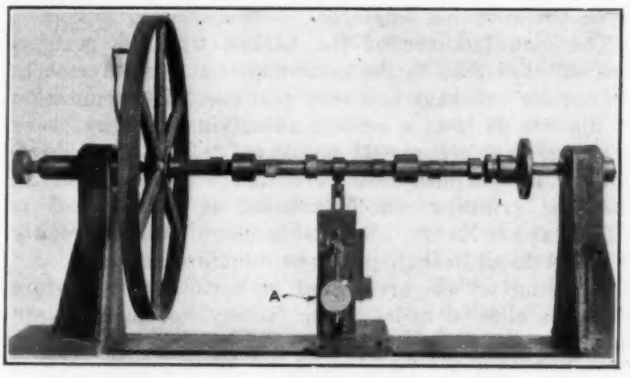


FIG. 12—TESTING A FINISHED SHAFT

A device for testing the cams is shown in Fig. 12 where the graduated wheel shown indicates the degrees at which certain movements of the cams take place and the dial indicator A, shows the exact throw of the cam being tested at each point of its contour.

Idleness Is Contagious

BY ROBERT GRIMSHAW

Watchmakers say—with what degree of truth, I do not know—that if a number of clocks stand on a shelf, some tending to run too fast and some too slow, the fast clocks will slow down and the slow ones will speed up to a noticeable degree.

I do know this: A slow workman will lessen the speed of a fast one beside him, while his own speed will increase. But on the principle that disease is more catching than health, the slow worker's influence for harm will be greater than the fast one's influence for good. The workman is not conscious of the influence.

There are often instances where a fast or a normal worker, put next to a slow one, will purposely reduce his own speed, so as not to "give away his neighbor."

All this shows the desirability of a record of output by which standards, especially minimum standards, may be established.

Grinding Wheel Breakage and Its Causes

What Produces the Stresses Resulting in Wheel Breakage—Effect of Over-speeding—Heating the Wheel Face and Spindle Bearings

By HAROLD E. JENKS
Instructor in Mathematics U. S. Naval Academy

THE subject of grinding wheel breakage is one which forcibly and frequently brings itself to the attention of the wheel user and the wheel manufacturer, and is of great importance to both. Whenever a grinding wheel, however well it may be protected, breaks in operation, there is always the possibility that flying fragments of the wheel may cause the loss of life or serious injury of persons nearby, particularly of the operator of the wheel. Financial loss is always involved, due to the loss of the wheel itself, loss of time in mounting another one, and to the possible breakage of parts of the grinding machine. If a man is killed or injured by the breakage, further financial loss has to be borne by his employer.

The manufacturer of the broken wheel is perhaps less affected than is the consumer, but his interest in preventing breakage is a very real one. The reputation of his wheels is to a certain extent impaired by every breakage that occurs. If breakages take place too frequently he will lose customers, unless it can be shown that the grinding wheels are not at fault, which is often hard to prove. Reputable manufacturers realize this and do all in their power to minimize breakage.

Grinding wheels are tested in various ways before they are allowed to leave the factory, to make certain that they are sound and can be safely run at the speeds for which they are recommended. Some manufacturers ask for the return of broken wheels, and maintain a board of experienced men to examine them and determine, if possible, the cause of breakage. If it can be shown that the wheel itself was at fault, the manufacturer is expected to replace it at his own expense. In cases where breakages constantly and persistently occur with some particular consumer, men are sometimes sent by the manufacturer to observe the wheels in action under operating conditions, and to report on probable causes of breakage and possible methods of preventing it.

From the foregoing introductory remarks the desirability of reducing grinding wheel breakage to a minimum becomes evident. The purpose of this article is to show as clearly as may be possible the underlying causes of breakage, and to give whatever other information may be necessary in order that an intelligent attempt may be made toward its prevention in any given case.

Primary Breakage Causes

Breakage of a grinding wheel while in operation may be due to any one of the following primary causes, or to a combination of two or more of them:

(1) Centrifugal force due to rotation of the wheel.
(2) Direct pressure exerted by the work upon the wheel.
(3) Heating of the wheel.
(4) Heating of the wheel spindle.
(5) Pressure on the side of the wheel.
(6) Improper mounting.
(7) Impact on the side or face of the wheel.
(8) Cracks or flaws in the interior of the wheel.
(9) Variation in density of wheel material.
(10) Lack of balance.
(11) Initial stresses in the wheel.

Evidently these causes are not entirely independent; for example, heating of the wheel is a result of direct pressure by the work; but the type of stress produced by direct pressure is entirely different from that due to heating, hence separate enumeration and treatment of these two causes of breakage are necessary. In general, it is thought that the above list has been condensed as much as possible to still allow a clear discussion of the subject.

By stress, as used here, is meant the force acting between the particles of wheel material per unit of area, ordinarily expressed in pounds per square inch. Wheel material is much weaker under tensile than under compressive stress; that is, a much smaller force will break it if tending to pull its particles apart than if tending to push them together. For this reason, stresses are here specified as tensile or compressive, it being understood that compressive stresses are not usually important as sources of breakage of grinding wheels. It is possible to obtain mathematical proof of many statements made below regarding the amount and position of the various stresses in wheels, but this is beyond the scope of the present article and is therefore omitted.

It is very important to note that while not one of the stresses existing in a wheel may be excessive, the combination or resultant of two or more of them may be sufficient to cause breakage. This fact will be frequently referred to in the following paragraphs.

Diametral Cracks from Tangential Stresses

Centrifugal force due to rotation of the wheel.—In any body which rotates about an axis, stresses are induced at every point due to centrifugal force, which for the purpose of this article may be defined as the force tending to make the body fly apart. In a grinding wheel these stresses are of two kinds: a radial stress acting in the direction of the radius of the wheel, and a tangential stress acting in a direction perpendicular to the radius, as illustrated in Fig. 1. Both these stresses are tensile, and their amounts vary as the square of the speed of the wheel, which means that if the speed is doubled, the stresses are quadrupled.

The radial stress is zero at the circumference of the wheel and at the hole, and reaches its maximum value at a point distant $\sqrt{Rr}$ from the hole, measured along the radius, R and r being the radii of the wheel and hole, respectively. In comparison with the tangential stress the radial stress is unimportant.

The tangential stress is much greater than the radial, and reaches its greatest value at the circumference of the hole. For a given speed and diameter of wheel, this maximum tangential stress increases slightly as the diameter of the hole is made larger, and in cylinder wheels becomes about 20 per cent greater than in disk

wheels with holes of ordinary size. This is a very important stress, since it always exists when the wheel is in motion, and because of the location of its maximum at the circumference of the hole, where it readily combines with other maximum stresses to produce a resultant stress large enough to cause breakage.

A wheel breaking from the effect of centrifugal force alone cracks approximately across a diameter, the crack starting at the hole and extending in opposite directions outward to the face, as shown in Fig. 2. This is of course the initial break, after which the wheel may or may not split into a larger number of pieces of irregular shape and varying size. It is not impossible that initial diametral cracks may in some cases start at several places simultaneously, as theoretically there would be an infinite number of these cracks, providing the wheel were of absolutely uniform strength throughout. Practically, due to variation in the wheel material, there must nearly always be one diametral plane that is weaker than any other, and the first crack will naturally start across this plane.

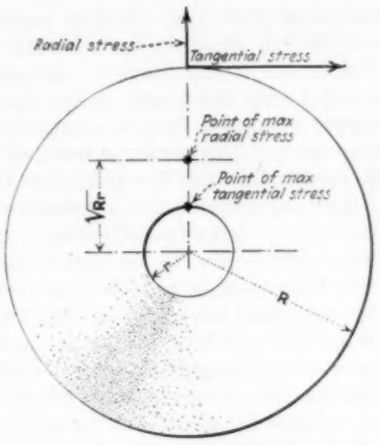


FIG. 1—STRESSES FROM CENTRIFUGAL FORCE

Reliable grinding wheel manufacturers test all wheels before they leave the factory by running them at a speed approximately twice that for which they are designed and recommended, thus obtaining a factor of safety of about four. It would then appear that breakages due to speed alone must be few in number. Such is indeed the case, yet they do occasionally occur from such causes as shifting thoughtlessly from large to small pulleys, placing wheels of large diameter on spindles running at speeds intended for smaller diameters, or substituting for a wheel running at the correct speed one of different grain and grade designed for lower wheel speed. In other words, most breakages due to speed are really due to over-speeding, either through carelessness or ignorance on the part of the operator.

FIG. 2—STARTING OF CRACKS DUE TO CENTRIFUGAL FORCE

The writer well remembers his first and only speed breakage. He had mounted a 14-in. wheel on a cylindrical grinding machine that he had never before used, and knowing nothing about the machine or its combinations of pulleys, he asked one of the men in the shop if the wheel would stand "all the speed the motor could give it." The reply was in the affirmative, but before the speed was two-thirds that which could have been obtained the wheel exploded with great violence, breaking off part of the protecting hood, but fortunately doing no other damage. Needless to remark, the writer has made sure of his spindle speeds since that time, and as stated above, he has never had another breakage from centrifugal force alone. In fact, most breakages of this type could have been as easily prevented as this one.

Direct pressure exerted by the work upon the wheel.—By direct pressure is meant pressure on the face of a wheel in operation directed toward its center as illustrated in Fig. 3. Stresses produced by this pressure are of two kinds, radial stress and bending stress.

The radial stress is the same as would be produced by an equal pressure if the wheel were not revolving, and is principally compressive. It is usually small, and is unimportant as a cause of breakage.

Contact between the work and the face of the revolving wheel produces a frictional force, the amount of which is proportional to the direct pressure and which is in a direction tangent to the wheel face. This force causes bending stresses along any diametral section of the wheel, which are tensile on one side of the center and compressive on the other. These stresses reach their maximum value at the face of the wheel, but are usually comparatively small and unimportant.

Heating of the wheel.—Every student of grinding knows from experience that much heat is developed at the point of contact of wheel and work, and that in cases where grinding is done dry, the wheel may become very hot. Comparatively few, however, realize the importance from the standpoint of possible breakage, of the stresses due to this heating. As a matter of fact the stresses produced by the unequal expansion of different parts of the wheel may reach a large value so that many breakages are no doubt due to this cause.

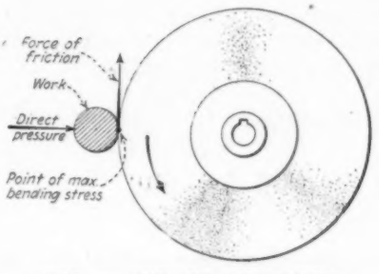


FIG. 3—DIRECT PRESSURE STRESSES

These stresses are similar in character to those produced by centrifugal force and are as in that case, of two kinds—radial and tangential. They may vary greatly in amount according to variations in temperature of different parts of the wheel, an exact determination of their amount in any given case being difficult if not impossible.

The greatest tensile stress occurs at the circumference of the hole and hence combines at that point with the maximum tensile stress due to the centrifugal force, shown in Fig. 1. This is an important statement, as both these stresses may be large and their resultant may easily cause breakage.

A few years ago the writer assisted in making some tests of the effect of heat alone upon grinding wheels. An electric heating coil was arranged to cover the entire surface of the face of the wheel to be tested and heat was gradually applied. The wheel was not in motion, so that the effect could be due only to heat.

At a temperature of the circumference averaging from 70 to 115 deg. C., the wheels tested cracked along a diametral plane, some with sufficient force to entirely separate the two halves of the wheel. With the heat thus applied, from 40 to 70 minutes elapsed before breakage occurred. It should be borne in mind that the stress due to centrifugal force was not present in these tests, so that it is reasonable to conclude that under similar heating conditions a wheel of the same type in operation would break at a still lower temperature and probably in a shorter time. Actual heat breakages in operation are in very close agreement with this conclusion.

As stated above, the typical heat break is a diametral crack, the same as in the case of breakage due to centrifugal force. It is evident that a fracture resulting from a combination of heat and speed stresses would be of the same type.

Heating of the wheel spindle.—Tight or insufficiently lubricated bearings on a grinding machine may cause heating of the wheel spindle. In case the wheel bushing fits the spindle tightly, the expansion of the latter may cause tensile stresses of considerable magnitude in the wheel. This is clearly the case of a thick cylinder under internal pressure. The stresses produced are similar in character to both those due to centrifugal force and those due to heating of the wheel. They are of two kinds, radial and tangential, as in those cases, and the maximum tangential tensile stress occurs at the circumference of the hole. Hence the maximum stresses would combine at that point and breakage might occur from the resultant stress. The typical break due to heating of the wheel spindle would be a diametral crack, as in the case of breakage due to centrifugal force.

(To be continued.)

Keeping the Mill A-Going

BY A. L. DEVINNE

There are, of course, manufacturing and other businesses where the initial outlay that makes part of the overhead expense is so slight that any slackness of work, any lowering of the efficiency percent of any worker, would cause but little damage beyond the immediate sphere of action of the worker in question. In fact, about the only loss would be that of the inefficient worker himself.

Where, however, as in some lines, the initial outlay is great, and rent, insurance, taxes, repairs and salaries constitute the greater part of the cost of production or service, "the mill must be kept going" in the figurative sense, if great loss is to be avoided. Here, the foreman may be the prime factor that determines whether or not either material or human wheels stand idle, or rotate intermittently or unprofitably. In too few establishments is the amount of overhead percent revealed to the workers—even to the foreman, or if known, justified in the workers' eyes. If the amount—or better yet the percentage—were a matter of common knowledge, there would be a greater chance for the employees to see the necessity for exerting themselves to keep down this element in the cost per product unit. The average workman, however, in charging the employer with making enormous profits, figures the cost of the job as material plus labor cost, and of course, having this idea may be excused if in his ignorance he thinks the employer is getting rich at his expense.

Apprenticeship in the Metal Trades—A Report Full of Helpful Suggestions

The committee on industrial education of the National Metal Trades Association, consisting of Harold C. Smith, William M. Taylor, John C. Spence and Philip C. Molter, has done an excellent piece of work in getting out its report on apprenticeship in the metal trades. The foreword points out that, while semi-skilled men can usually be had, there is nearly always a dearth of the skilled, all-around mechanics on which so much of the future of the industry depends. These skilled men are not only necessary in the shop but are the natural supply of future foremen, superintendents, and possibly managers. The pressing need of a supply of such men is responsible for the publication of this report.

The suggestions for apprenticeship contracts for the training of boys in both shop and school, and the relations which are to be maintained are commended as being thoroughly practical, recognizing the frailties of plain, human boys and not expecting them to be angels in embryo. The training is based on a four-year apprentice training with due allowance for college or other experience. It is recommended that no piece work or premiums be given during apprenticeship in order to eliminate the incentive to stay on a given job longer than necessary.

One particularly good suggestion deals with the shifting of apprentices from shop to shop in order to give them the desired training. Small shops can thus take apprentices as well as large ones, can give the boys its part of his training and then pass him on to another shop in the town. In this way every small shop gets its quota of boys in various stages of training and stands an equal chance of having all-around mechanics at the end of the training period.

While training and not wages is the first object of apprenticeship, the committee realizes that finance cannot be overlooked. It is recommended that the rate be sufficiently high to attract the highest type of boy. They suggest that the wage be increased every six months beginning at one-third the journeyman's rate and reaching 85 per cent for the last six months of service. The committee also advises against requiring a deposit from the apprentice and also against prosecution of any boy who breaks the contract. It does not feel that the first is desirable or that an unwilling apprentice can be of much value.

Six types of apprenticeship are suggested, each designed to fit different shop conditions, and covering both large and small shops. The committee also suggests a definite division of different kinds of work to suit shops of various kinds and sizes. These suggestions should be of great value to everyone contemplating introducing an apprentice system, while those who already have one in operation can use it as a check on their own methods.

One of the interesting and encouraging features of the course is that it includes both economics and civics, two subjects of vital importance to the individual, to the employer and to the welfare of the country at large. This is along the right line, as the more mechanics know of the economics of production and distribution, the fewer illogical and erroneous ideas will pervade industry. Both the National Metal Trades Association and the committee that prepared this report, are to be congratulated on the publication of such a progressive plan. It should be carefully considered by every manufacturer in the metal industry.

Machining and Assembling Operations on Pneumatic Tools

The Second of Four Articles—Turning and Drilling Crankshafts for Air Motors—Machining Valves—Fixture for Rolling Segment Stock

BY HOWARD CAMPBELL
Western Editor, *American Machinist*

THE method of centering the small crankshafts that are used in the Thor air motors manufactured by the Independent Pneumatic Tool Co., Aurora, Ill., is shown in Fig. 11. The two shafts *A* have been straddle-milled flat at the inner ends and then grooved vertically so as to form jaws. Each jaw has a steel pin, 1 in. in diameter, projecting from the back side so as to ride in the slot *B* and in the slots *C* in the plate *D*, Fig. 12. The end of each pin is encircled with a hardened bushing to take the wear. It can easily be seen that when the handle *E* is raised the jaws will spread apart, due to the fact that the slots *C* are cut on an angle. And when the handle *E* is lowered the jaws will close, holding the shaft in position for centering. The lower end of the shaft locates in a hole in a stationary block.

The drilling of the counterweight rivet holes and holes for lightening the crankshaft for a "close quarter" drill is illustrated in Fig. 13. The three holes *A* and the two holes *B* are for the purpose of lightening the crankshaft, and these are also located on the heavy side of the shaft so as to assist in balancing. Holes *C* are for the counterweight rivets. The under side of the bushing plate *D* is counterbored about $\frac{1}{8}$ in. to receive the gear end of the crankshaft, which is located in the jig by loosening the knurled screws *E* and *F* enough so that the entire top plate can be raised the necessary amount. The flat side of the lower end of the shaft is aligned with the pin *G* which insures the holes being drilled in the correct position.

The operation of milling the cheeks and roughing the pins of a crankshaft for a "close quarter" drill is illustrated in Fig. 14. The machine is a Becker vertical milling machine. Two heads are clamped on the crank for this operation, one on each end. Each head has a hole in it which slips over the end of the crankshaft, and a center hole to receive the centers of the fixture *A*. Each head is attached to the shaft by means of a setscrew, as shown at *B*. Neither the setscrew in the lower head nor the lower center can be seen in the illustration. Each head also contains a slot which locates in the lower face or lower part of the fixture, as shown at *C*. The upper end of the shaft locates on a screw center which is withdrawn when the piece is to be changed or removed.

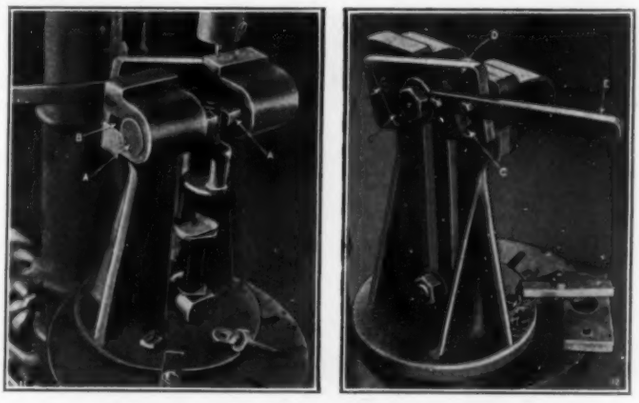
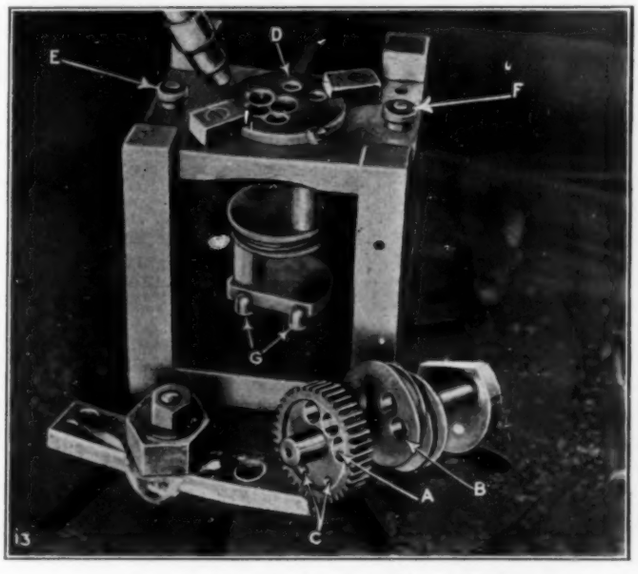


FIG. 11—CENTERING AIR DRILL CRANKSHAFTS. FIG. 12—VIEW SHOWING OPERATION OF FIXTURE

When pieces or cutters are to be changed, the piece



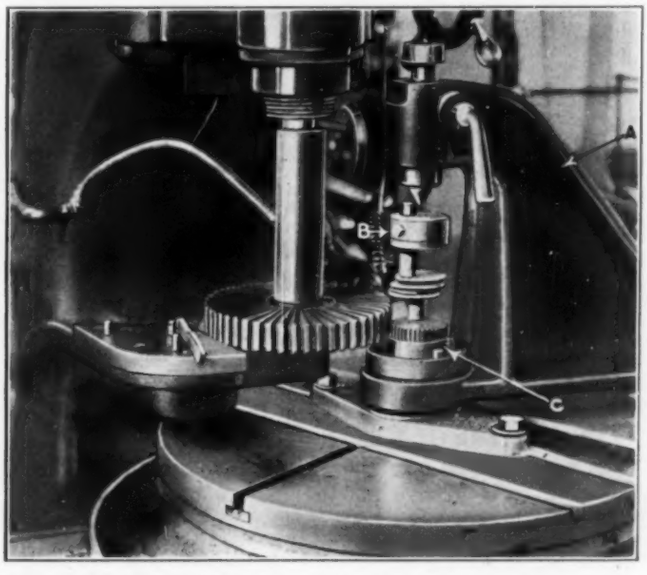


FIG. 13—DRILLING COUNTERWEIGHT RIVET AND "LIGHTENING" HOLES. FIG. 14—FACING CHEEKS AND ROUGHING OUT CRANKPINS

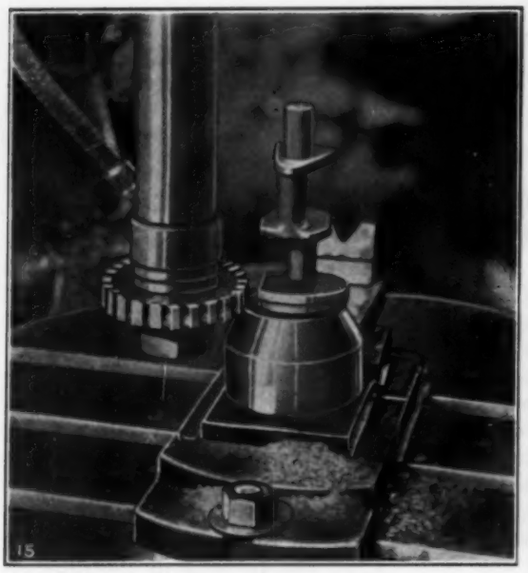


FIG. 15—MILLING THE PISTON CLEARANCE.

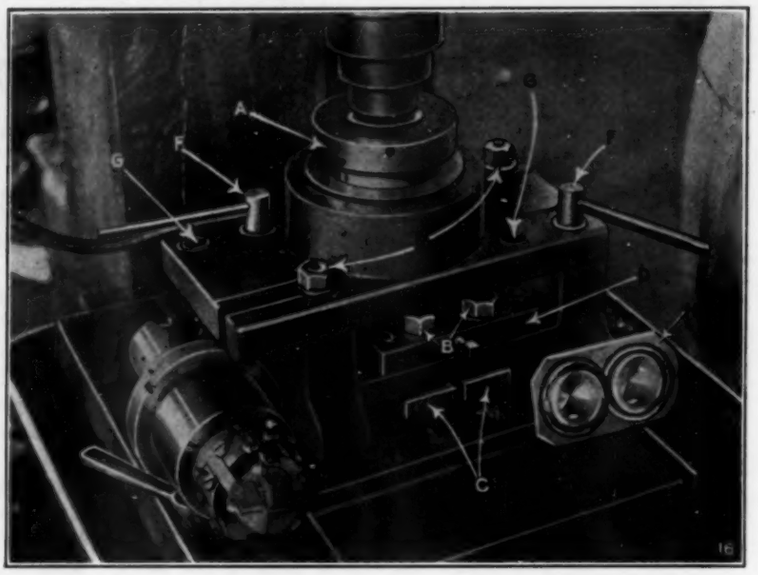


FIG. 16—JIG FOR BORING JOURNAL BEARING CASE COVERS

is fed away from the spindle, using the longitudinal feed. When ready to mill a new piece, the table is fed in to a stop, then the table is rotated as far as possible, giving the cutters an opportunity to mill nearly around the circle. When one crank has been roughed out, the piece is inverted and the operation is repeated.

The operation of milling the piston clearance on a different type of crankshaft is shown in Fig. 15. The lower end of the shaft is held in a collet chuck which is attached to a plate and bolted to the table of the machine. The chuck is located off center in the direction of the spindle, and the piece is fed past the cutter by rotating the table.

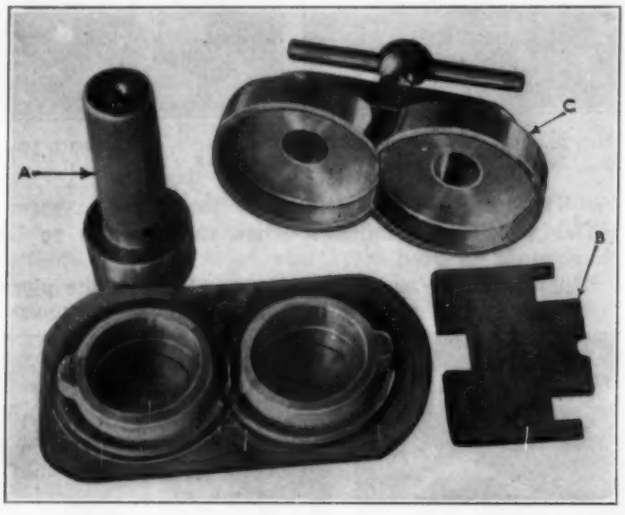


FIG. 17—INSPECTION GAGES FOR BEARING CASE COVERS

The set up shown in Fig. 16 is for boring and recessing the crank journal roller bearing case cover for a No. 8 air drill. A cover is shown at *H*, and an extra cutter can be seen lying on the table of the machine.

The stop collars *A* determine the depth of the bore. The piece is put into the fixture through the left end, locating in a groove and against a stop at the right end. Tightening the bolts *B* clamps the piece between the strap *C* and the piece *D*. Two cutters are used in this operation, the roughing cutter being shown in the spindle of the machine and the finishing cutter being shown lying on the table at the left. Both holes are roughed out before being finished. After one hole has been bored, the nuts *E* are loosened, the pins *F* withdrawn, and the entire fixture is moved over until the pins *F* will slip into the holes *G* at the top of the fixture. Then the nuts *E* are tightened and the boring operation repeated.

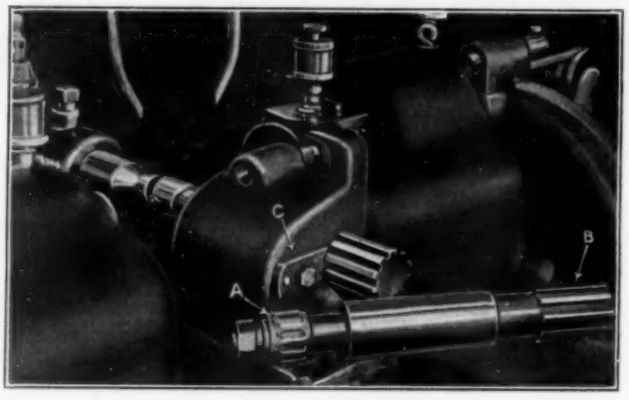


FIG. 18—MILLING SLOTS IN ROLLER RETAINER

The tools for inspecting the work done in the opera-

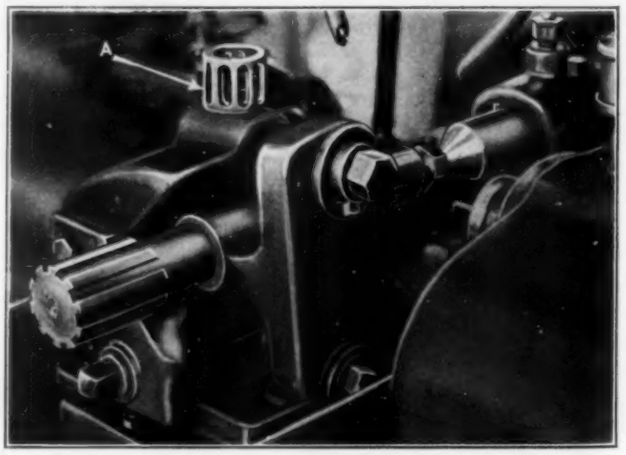


FIG. 19—VIEW OF MACHINE FROM OPPOSITE SIDE

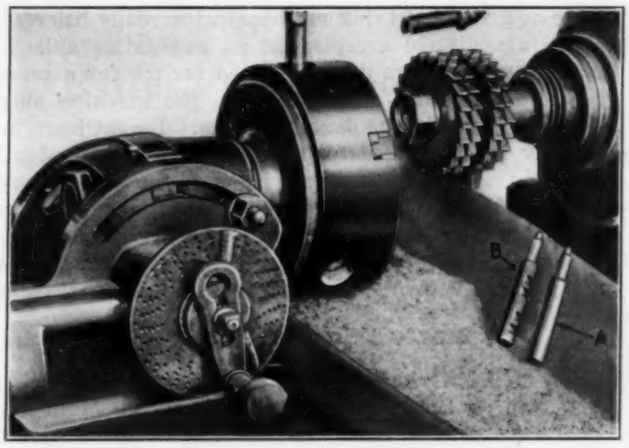


FIG. 20—SET-UP FOR VALVE MILLING OPERATION

tion just described are shown in Fig. 17. The plug *A* must be a push fit in the bore. The gage *B* is for testing the distance from the face of the cover to the bottom of the bearing hole. The use of the gage *C* insures that the two holes are in correct relation to each other and that the O.D. is correct.

Milling Slots in Roller Retainers

The equipment used in milling the roller slots in the roller retainer for the air drill is illustrated in Fig. 18 and 19. The retainers, one of which can be seen at *A* in both figures, are pressed onto the end of the crankshaft after the rollers are in place, forming a very efficient roller bearing. The arbor that is used for this operation is turned to as large a diameter as practicable at the center, in order to afford as much surface as possible for the clamping action of this fixture. The end of the arbor is splined as can be seen at *B*, Fig. 18, and the hardened plate *C* is made with a tongue which fits into one of the grooves as the arbor is clamped in position. The grooved end of the arbor is used as an index plate for spacing the slots in the retainer, the tongue on plate *B* acting as the index pin.

The machine on which this operation is performed is a Pratt & Whitney duplex milling machine, arranged so that two cutters are operating simultaneously on opposite sides of the piece. Both cutters feed in very slowly while the table is traveling back and forth the length of the slots. After the slots have been milled through, the cutters withdraw, the whole action being automatic. One operator runs three of these machines simultaneously.

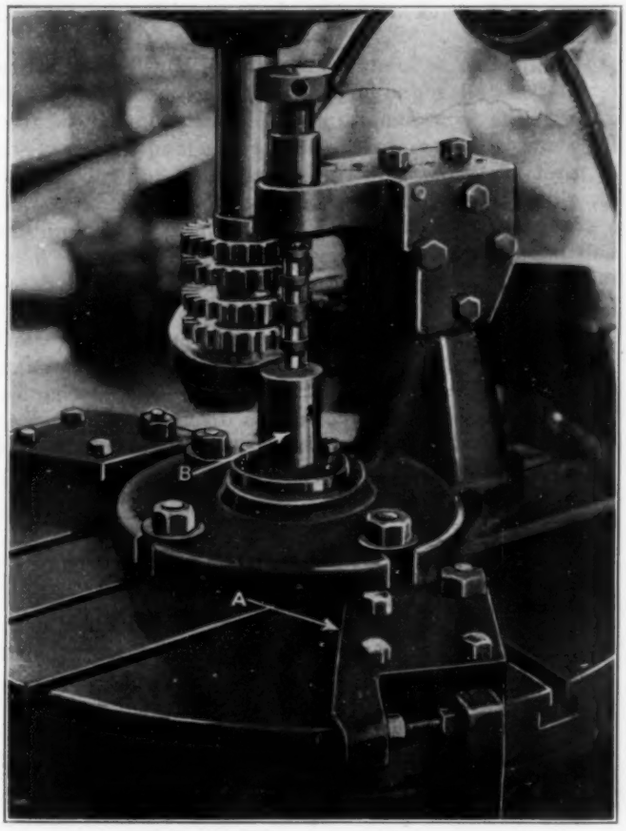


FIG. 21—MILLING VALVES ON A VERTICAL MILLING MACHINE

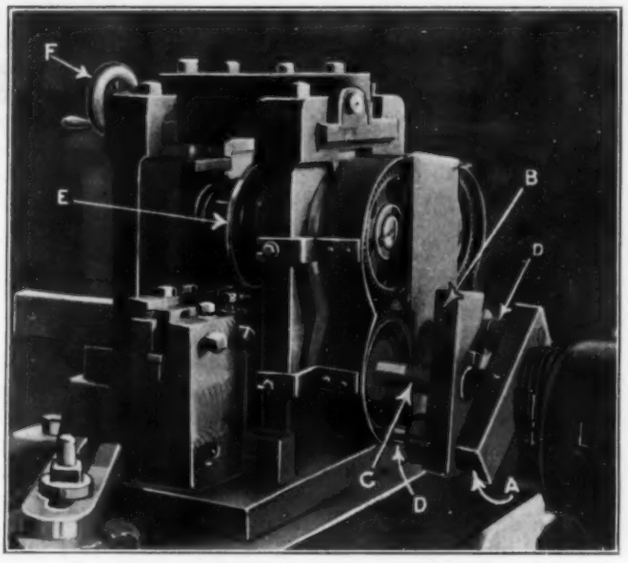


FIG. 22—ROLLING COMMUTATOR SEGMENTS

The illustration, Fig. 20, shows a milling machine set up with four cutters which are used for milling the valve blank *A* into the form with four grooves shown at *B*. The valve is held at one end in the chuck and the other end is held on a center which does not show in the illustration. The table is fed longitudinally into the cut until the required depth is reached, then the chuck is rotated by means of the dividing head so that the grooves surround the base with the exception of a small rib on one side, then the table is withdrawn.

The use of a Becker vertical milling machine for a similar operation is shown in Fig. 21. Instead of milling straight across the piece, however, the grooves are milled practically three-fourths of the way around the piece, this action being accomplished by rotating the table of the machine. The limits of the cut are determined by two stops, one of which can be seen at *A*. A slot in the lower end of the valve locates on a key in the bottom of the hole in the round piece *B* and the upper end is held in place by a center of the screw type. The piece *B* turns the valve as the table is rotated.

Rolling Commutator-Segment Bars

The attachment shown in Fig. 22 was designed for a unique operation—that of rolling out round copper bars to flat, knife-blade shape. The bars are orginally 0.230 in. in diameter, and after rolling they are 0.425 in. wide, 0.070 in. thick at one side and 0.014 in. at

the other. This is equal to a taper of 7 deg. 30 min. These bars are made into commutator segments for the motors that are used in the electric drill. The attachment is blocked up on the bed of a lathe so that it can be driven from the spindle as shown. The driver is the block *A*, which is attached to a stub arbor and drives the block *B* on the end of the stub shaft *C* by means of the two pins *D*. A short section of rubber tubing is slipped over each of these pins to take the shock.

The shaft *C* drives one gear and this in turn drives the other three gears in train, which is necessary in order that the upper one of the two hardened steel rollers may be raised and lowered as the different diameters of stock are used. It is obvious that if only two gears were used, the rollers would always have to work at the same distance between centers in order to keep the teeth of the gears in mesh. The shaft of the upper roller runs in bearings contained in two blocks which are raised and lowered by means of the worm gear operated by the handle *F*. The faces of the rollers, one of which can be seen at *E*, are ground to give the correct taper to the copper as it is fed through the machine.

Recollections of an Old-Time Mechanic

By John J. Grant

My next attempt was a pair of roller skates, made because my father forbade me to skate on ice. I had good success with them and was supposed to have been the original inventor of roller skates until someone several years after, in an article in the American Machinist, proved that there had been a priority of invention dating back to about the year 1600.

I had done considerable work on clocks and made a complete grandfather's clock, movement, dial and case, and had it running before I was thirteen years old. I would give many dollars to have that clock and my first steam engine at present; but when I went to learn my trade, or rather when I had been at it long enough to know more than the superintendent, I took them apart to refinish them, with the usual results in such cases—they were never assembled again.

The next thing I tackled was marine engineering. I made a boat about twelve feet long and put paddle wheels in it, but one night the rain descended and the floods came; it broke loose from its mooring and went over the dam, and that was the end of my ambition to become a second Robert Fulton.

The turning point in my life was when an oil merchant, Mr. Reisner, came into the factory and saw my steam engine running, taking steam from the heating pipes. This gentleman told my father that I would certainly make a second Corliss and that I must get started at once to learn my trade. He lived in Providence and was well acquainted with Corliss. In a short time I received an invitation to visit him at his home. I was then nearing the advanced age of fourteen years and it was a great day for me when I started, with a hundred instructions from the whole family of how to conduct myself, including one from my dear old mother, not to whittle around the house without cleaning up afterwards. I set forth for Providence, my first trip away from home. If ever a boy had as good a time as I did on that visit, I have never heard of it.

I was taken down to the Corliss shop and introduced to the men in the high places, as the coming mechanic of the age, which I think my benefactor really believed. I was immediately accepted as an apprentice and indentures were drawn up and signed for me for a seven year apprenticeship, four years in the machine shop and three years in the drafting room. I went home to have my hopes dashed to pieces by the refusal of my father to sign the papers. He said he had served seven years apprenticeship and that I should never do it. He wrote to Mr. Reisner to that effect and in a short time I received word that he had secured for me a place at Brown & Sharpe's for a three years' term.

Brown & Sharpe's Old Shop

How well I remember the day I went with my father to Brown & Sharpe's shop at 115 South Main St., Providence, where I met Mr. Sharpe, who questioned me and also read the riot act to me; and Mr. Brown who took me under his wing and said, "You look like a good boy." Well boys, you who have served your apprenticeship in the old shop and know what it was to scrub the sink so that it would satisfy Mr. Sharpe, and have had Mr. Brown stand by you and encourage you when you made a slip or a bad job, know what it was to be brought up in a shop where boys were instructed; it would be far better if there were more of those shops in the present day.

Of course, the kind of work that was done at that time in Brown & Sharpe's was not the kind that made the all around mechanic, but it laid the foundation for it. The country job shop was the place where you could take a post graduate course that would fit you to repair a sewing machine in the morning and in the afternoon put a soft patch on a boiler, lying on your back in a hot firebox. But at Brown & Sharpe's you got it pretty thoroughly drilled into you that quality and not quantity of work was the first requisite in a good mechanic.

I would like to know if any of the boys of that time remember the sound of the bell that used to call us down to the front shop to get a lecture from Mr. Sharpe for some infraction of the shop rules; and then perhaps to meet Mr. Brown on the stairs when going back and have him try to talk severely to us about the shop being a school for the boys; and then because he thought he had hurt our feelings, hand each one a three or four-inch scale that he would explain was a little damaged—I could never see the damaged place.

Well both of them have gone and certainly have left their "footprints on the sands of time" and a name that stands high for all that is good in mechanics. That was a great combination—a disciplinarian and an easy boss—but the mechanics that they turned out are favorably known all over the world.

The Foreman as Liaison Officer

By C. E. Jensen

Those who have been "over there" know the importance—in fact the necessity—of the *liaison* or connecting link between different armies or divisions, or even brigades, the means of acquainting each, by word of mouth, with the plans and movements of the others who are expected either to co-operate actively or to remain ready for this or that contingency.

The foreman is the liaison officer between departments or production centers. Through his conferences and messages, efficient co-operation is secured.

Gears and Pinions for Electric Railway and Mine Service

The following suggestions for gear material, manufacture and finish are of special interest. They are recommended practice by the American Gear Manufacturers' Association for casehardened forged steel gears and quenched and hardened gears.

Manufacture

Material: All blanks for gears shall be made from openhearth steel which has been thoroughly worked to secure a homogeneous dense material, free from all injurious defects.

Chemical Properties and Tests (Casehardened Forged Steel Gears Only)

Chemical Properties: The steel shall conform to the following requirements as to chemical composition:

Carbon ..... 0.20% — not less than 0.12% nor more than 0.28%

Manganese .... 0.50% — not less than 0.40% nor more than 0.60%

Phosphorus .....not over 0.05%
Sulphur ..... not over 0.05%
} applies also to material for quenched and tempered carbon steel gears.

Check Analysis: A check analysis may be made by the purchaser or his representative from one or more gear blanks from each lot of 100 or fraction thereof ordered and this analysis shall conform to the requirements specified above. Sample for check analysis to be taken at the pitch line so that the blank will not be destroyed.

Physical Properties and Tests (Casehardened Forged Steel Gears Only)

Hardness: The hardness as shown by the scleroscope shall not be less than eighty, taken at the center of the top of the tooth after treatment.

Treatment: All gears, after the teeth are cut, shall be carbonized to a depth approximately one-sixth of the thickness of the teeth on the pitch line.

Finish—All Gears

Dimensions: The outside diameter *A*, Fig. 1, over the teeth as machined must not vary from that specified by more than plus zero (0) in. or minus $\frac{1}{32}$ inch.

The face *B* of the gears must not vary from the specified width by more than plus $\frac{1}{32}$ in, or minus $\frac{1}{32}$ inch.

The minimum thickness of the rim *C* under the teeth shall be as follows, measured $\frac{1}{8}$ in. from the edge of the rim:

Pitch	Thickness of Rim
3	$\frac{3}{4}$ in.
$2\frac{1}{2}$	$\frac{7}{16}$ in.
2	$\frac{1}{2}$ in.

Web: The web *D* of all gears shall have four $3\frac{1}{2}$-in. holes on $7\frac{1}{4}$ in. radius spaced with a tolerance of $\frac{1}{8}$ in. in center of webbed section, whenever the space will permit.

Bore: The diameter of finished bore *E* shall not vary from that specified by more than plus 0.001 in. or minus 0.0015 inch.

The diameter of rough bore E_E shall not vary more than $\frac{1}{16}$ in. over or $\frac{1}{8}$ in. under that specified.

The ends of finished bores shall be chamfered, *F*, $\frac{1}{16}$ in. on motor side to avoid injury to shaft when mounting.

Bore shall be measured with a pin gage or inside micrometer.

Hub: The face *G* of hub *H*, next to lining, to have a smooth bearing finish and run true with bore.

The variation from the specified dimensions of hub *H* and hub extension *L* shall not exceed the following:

Length of hub *H* overall, plus zero (0) in. to minus 0.02 inch.

Length of hub extension *L*, plus $\frac{1}{32}$ in. to minus $\frac{1}{32}$ inch.

Diameter of hub extension *J*, plus zero (0) in. to minus 0.03 inch.

Teeth: The thickness *K* of teeth at the pitch line must be to specified dimensions as a maximum or to

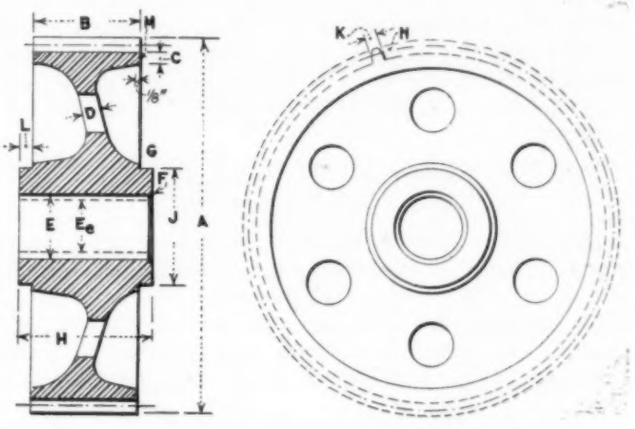


FIG. 1. DIMENSION CHART OF GEAR

specified dimensions minus 0.010 in. as a minimum.

The teeth shall be of the Brown & Sharpe standard $14\frac{1}{2}$-deg. involute form unless otherwise specified.

Marking

Marking: All gears shall be plainly stamped on motor side of rim *N* as follows:

Grade.

Month, year, serial number of manufacturer, consecutive for each month.

Name, initials or trade mark of manufacturer.

Inspection and Rejection

Inspection: All gears shall be tested for smooth running. The teeth must be equally spaced so that the gear will run smoothly in both directions with a master pinion.

Records of all chemical analysis and physical tests shall be kept by the manufacturer and shall be available to the purchaser for a period of one year.

Rejection: The purchaser reserves the right to reject any portion of or all of the material which does not conform to the above specifications in every particular.

CASEHARDENED FORGED STEEL PINIONS AND QUENCHED AND TEMPERED FORGED CARBON STEEL PINIONS

Manufacture

Material: All blanks for pinions shall be made from

openhearth steel which has been thoroughly worked to secure a homogeneous dense material, free from all injurious defects.

Chemical Properties and Tests (Casehardened Forged Steel Pinions Only)

Chemical Properties: The steel shall conform to the following requirements as to chemical composition:

Carbon ..... 0.20% — not less than 0.12% nor more than 0.28%

Manganese ..... 0.50% — not less than 0.40% nor more than 0.60%

Phosphorus ..... not over 0.05%
Sulphur ..... not over 0.05%
} applies also to material for quenched and tempered carbon steel pinions.

Check Analysis: A check analysis may be made by the purchaser or his representative from one or more pinion blanks from each lot of 100 or fraction thereof ordered and this analysis shall conform to the requirements specified above. The sample for check analysis to be taken at the pitch line so that the blank will not be destroyed.

Physical Properties and Tests (Casehardened Forged Steel Pinions Only)

Hardness: The hardness as shown by the scleroscope shall not be less than eighty, taken at the center of the top of the tooth after treatment.

Treatment: All pinions, after the teeth are cut, shall be carbonized to a depth approximately $\frac{1}{8}$ of the thickness of the tooth on the pitch line.

Dimensions—All Pinions

Diameter: The outside diameter *A*, Fig. 2, of the pinion shall not vary from that specified by more than

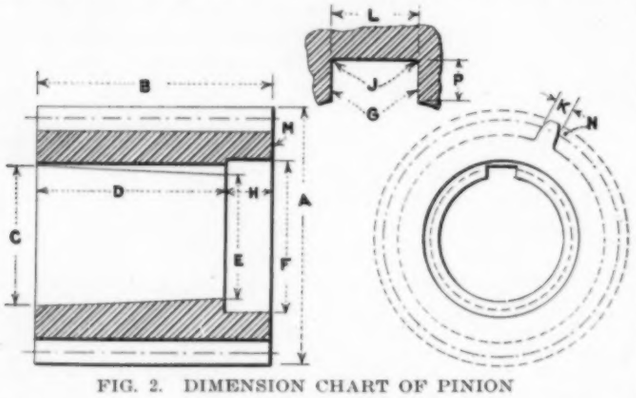


FIG. 2. DIMENSION CHART OF PINION

plus zero (0) in. or minus $\frac{1}{32}$ in. measured at the center of the face.

Face: The face *B* of the pinion must not vary from the specified width by more than plus or minus $\frac{1}{32}$ inch.

Bore: All bores *C-E* must be finished after treatment. The diameter of the bore must be such that the standard plug gage will not project less than $\frac{1}{32}$ in. or more than $\frac{1}{16}$ in. measured at the large end of bore *C* and have bearing the full length of *D* of bore *C-E*.

Counterbore: The depth *H* of the counterbore must not vary from that specified by more than plus zero (0) in. or minus $\frac{1}{32}$ inch.

The diameter *F* of the counterbore must not vary from that specified by more than plus $\frac{1}{32}$ in. or minus zero (0) inch.

Keyway: The sides *G* of the keyway must be cut parallel with the center line of pinion.

The width *L* of the keyway must not vary from that specified by more than plus 0.003 in. or minus zero (0) inch.

The depth *P* of the keyway must not vary from that specified by more than plus $\frac{1}{64}$ in. or minus zero (0) inch.

The fillet *J* at the bottom of the keyway shall have $\frac{1}{16}$ in. radius. With this specification $\frac{1}{16}$ in. clearance shall be provided between bottom of keyway and pinion key.

Teeth: The thickness *K* of teeth at the pitch line must be to specified dimensions as a maximum or to specified dimensions minus 0.010 in. as a minimum.

The teeth shall be of Brown & Sharpe standard 14½-deg. involute form unless otherwise specified.

Marking

Marking: All pinions shall be plainly stamped, preferably on the outer end *M* with steel letters approximately $\frac{1}{4}$ in. as follows:

Grade.
Month, year, manufacturer's serial number (to be consecutive for each month).
Name initials or trade mark of manufacturer.

Workmanship and Finish

Finish: All pinions shall be tested for smooth running. The teeth must be equally spaced so that they will run smoothly in both directions with a master gear.

All pinions shall be gaged with a standard taper plug gage, which shall be the same size as the nominal size of the bore at the large end.

Inspection and Rejection

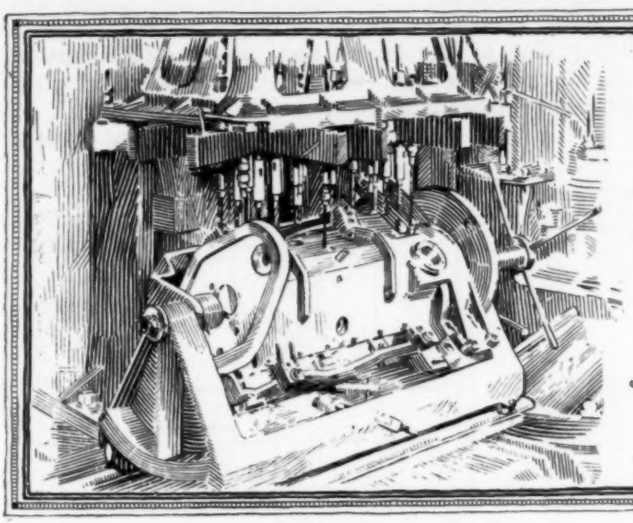
Inspection: All pinions shall be free from any seams, cracks or other defects that would in any way affect their service.

Rejection: The purchaser reserves the right to reject any portion of or all of the material, which does not conform to the above specifications in every particular.

Growth of Pennsylvania Employment Bureau

Some idea of the growth of state employment bureaus or offices may be had from the very interesting report of the Bureau of Employment of the Pennsylvania Department of Labor and Industry for the year 1921. This bureau has headquarters in Harrisburg and branch offices in Philadelphia, Pittsburgh, Scranton, Altoona, Pottsville, Lancaster, Williamsport, Kane, Erie, Johnstown, McKeesport, Meadville, Dubois, Wilkesbarre and New Kensington. It co-operates with other bureaus such as those of Mediation and Arbitration, Rehabilitation, Inspection, Occupational and Therapy, as well as with Federal agencies along similar lines. Each office has sections for men, women and juveniles, the latter department being conducted in co-operation with the public schools.

It is interesting to note that, in spite of industrial conditions, some of the offices placed more people in 1921 than in any previous year. The only conclusion is that employers have learned to rely more on the employment offices, as there were certainly fewer people employed in 1921 than in 1919 and 1920. This is borne out by a total of nearly 92,000 applications for workers from employers.



Tool Engineering

By

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Dowd Engineering Company, New York City

Tooling for Vertical Turret Lathes and Boring Mills Concluded — Machining Spherical and Formed Surfaces — Methods of Laying Out and Developing the Design of the Tools

MANY of the principles brought out in the article which treated of the design of attachments for horizontal turret lathes, are equally applicable to use on vertical turret lathes and boring mills. The construction of the machine, however, is somewhat different so that the application of attachments varies considerably, although the general principles may be much the same. In addition, the cutting action is usually more severe and the attachments must be built

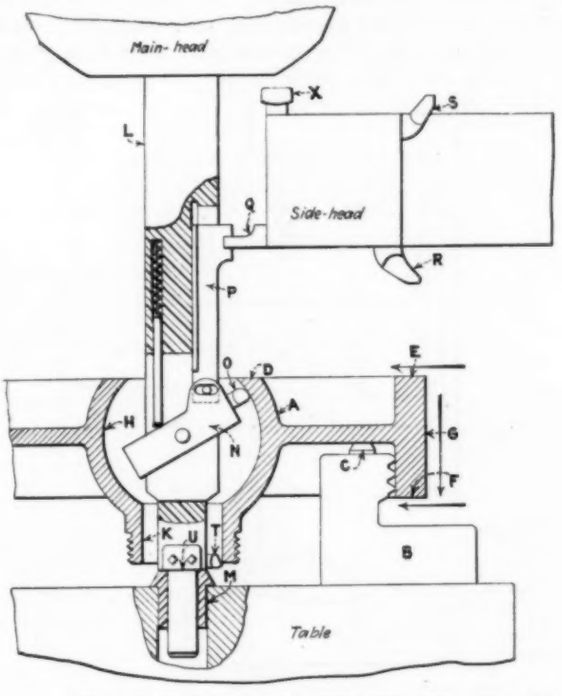

FIG. 402. SPHERICAL BORING ATTACHMENT

in a more substantial manner than those used on horizontal turret lathes.

In Fig. 402 is shown a piece of work *A* which is held by the inside rough surface in a set of special chuck jaws *B*. The web of the casting rests on hardened buttons *C* in the chuck jaws. The work which is to be done consists of facing the surfaces *D* and *E*, turning the outside diameter *G* and undercutting the flange *F*. In addition to this machining, both the spherical hole *H* and the straight hole *K* are to be bored.

A heavy bar L is held in one of the turret faces and piloted at the lower end in a bushing *M* in the center of the table. The bar is slotted to receive a swivel block *N*, which carries a tool *O* for generating the spherical surface. Connected to the swivel block is a sliding member *P* traveling vertically in a slot in the side of the bar and operated by the finger Q in the sidehead. The feed is obtained by using the down feed of the sidehead. The cylindrical hole *K* is bored by a tool *T* in the lower end of the boring bar. This tool is so placed that it completes its work shortly before the shoulder *U* strikes against the top of the bushing. In using this tool the sidehead is disconnected and the turret feed used, the latter being thrown out of engagement at the completion of the cylindrical boring cut.

The surfaces *D* and *E* are faced by standard tools in the regular toolholders of the turret. The rough- and finish-turning of the outside diameter *G* is done by the sidehead, using the tools *R* and *S*, respectively. The undercutting of the flange *F* is also done by the sidehead, using the tool *X* for the purpose. The peculiar part of this equipment is the combination of a straight and spherical tool in the same bar, as this condition is seldom found. The tools *T* and *O* are both arranged so that they can be moved for roughing and finishing and other tools substituted rapidly.

Generating a Spherical Surface

In Fig. 403 is shown a piece of work *A* which is to be turned at *B*, faced at *C* and *D*, undercut at *E*, turned at *F*, grooved at *G* and turned spherically at *H*. The hole *K* is also to be bored and reamed. All of these operations are to be done in one setting of the work, and as a consequence a considerable amount of special tool equipment is necessary. The jaws *L* grip the inside of the work in such a way that

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the tools in the sidehead used for undercutting will not interfere with the jaws. The table is provided with a central bushing which is used as a guide for the boring bars.

We are particularly interested in the turning of the spherical surface *H*, and the equipment for this purpose consists of a heavy casting *N* which is bolted to the face of the turret. On this casting a dovetailed slide *O* is mounted so that it is free to move longitudinally. The lower portion of this slide is built out so that it supports the tool P, which is used for turning the spherical surface. Both roughing and finishing tools are made so that they fit the slide in the holder, so that one can be used after the other in the turning operation. The sidehead contains a form plate *Q* of the proper curvature, so that when the roll *R* is in

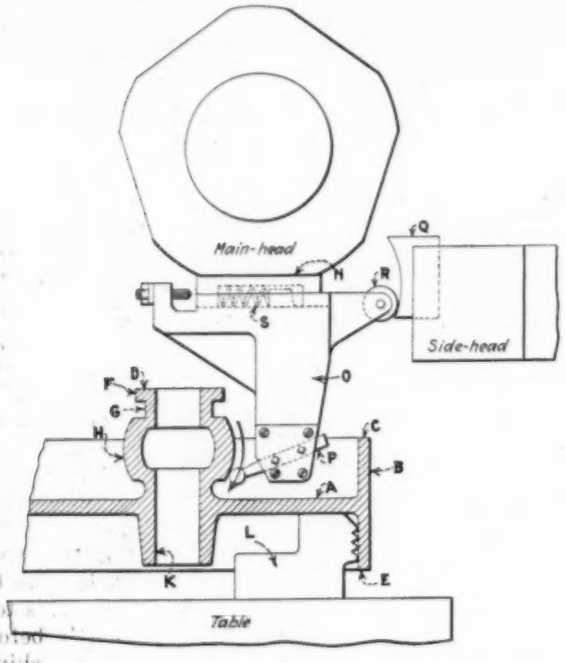


FIG. 403. SPHERICAL TURNING ATTACHMENT FOR VERTICAL TURRET LATHE

contact with the curved surface the correct radius will be generated at *H*. A heavy coil spring *S* keeps the roller in contact with the form, and the down feed of the turret provides the power necessary.

Other tools are used in both turret and sidehead for performing the boring, facing, turning and grooving operations. The work shown here is rather unusual in shape, and because of the fact that the spherical surface is in such a position that it cannot easily be reached by the sidehead tools, the design and application of a spherical turning device requires considerable ingenuity. In operation it was found that a fine feed was necessary in order to produce the desired finish.

Concave and Convex Surfaces

If a vertical boring mill of the two-head type is used for manufacturing work, the generation of a curved surface causes considerably more trouble than if the work is done on a vertical turret lathe. Fig. 404 shows a piece of work *A* which is held in chuck jaws *B* in such a way that the curved surface *C* can be machined to the desired form, the plane surface *D* faced, and the outside diameter turned. It is desirable to perform all of these operations in the same setting and without loss of time. The work is set up in the jaws so that the under side of the flange rests on hardened buttons which are high enough so that the turning tool for the outside diameter will not strike the chuck jaws.

Two special brackets *E* and *F* are applied to the

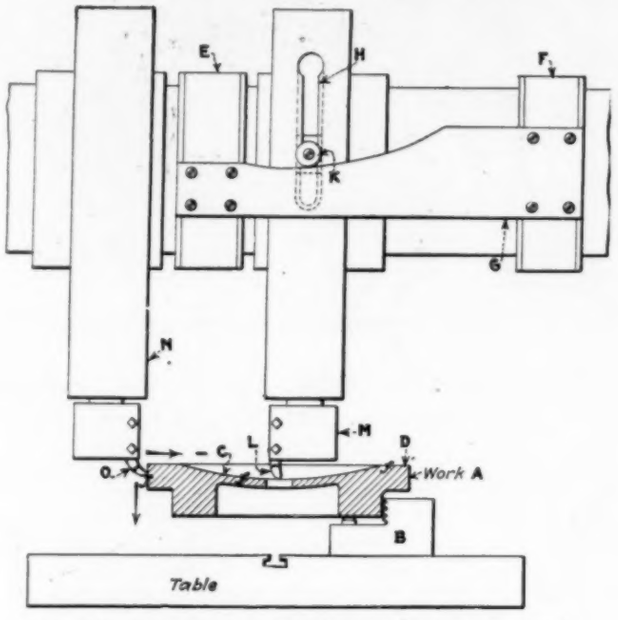


FIG. 403. SPHERICAL TURNING ATTACHMENT FOR VERTICAL TURRET LATHE

rails of the machine and on these brackets a form plate *G* is fastened. The toolslide is slotted at *H* in a vertical direction, in order to permit the use of a block which carries a roller *K*. The block can be adjusted ver-

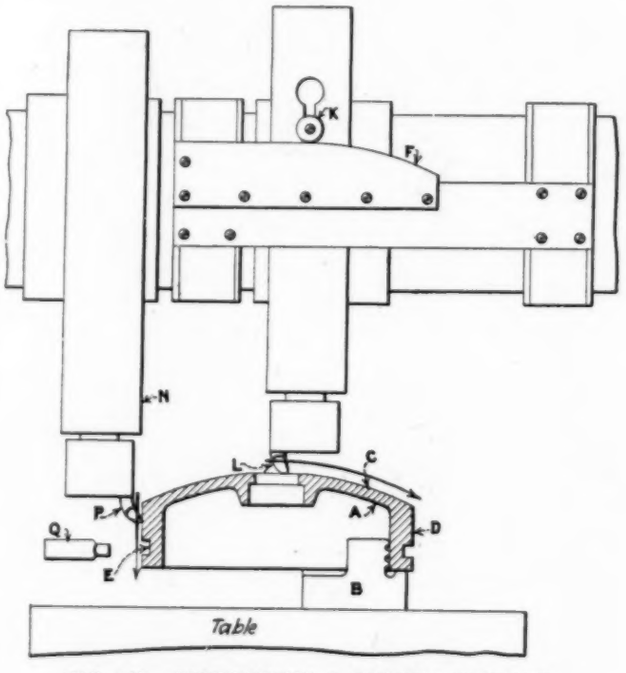


FIG. 405. GENERATING A CONVEX SURFACE

tically in order to compensate for variations in the tool setting. In operation the tool *L*, held in a standard holder *M*, is controlled in its movement by the position

of the roll K with respect to the form. When the feed is engaged the tool travels in the direction indicated by the arrow, thus generating the concave surface.

While this tool is in operation, the left-hand toolslide N faces the surface D and turns the outside

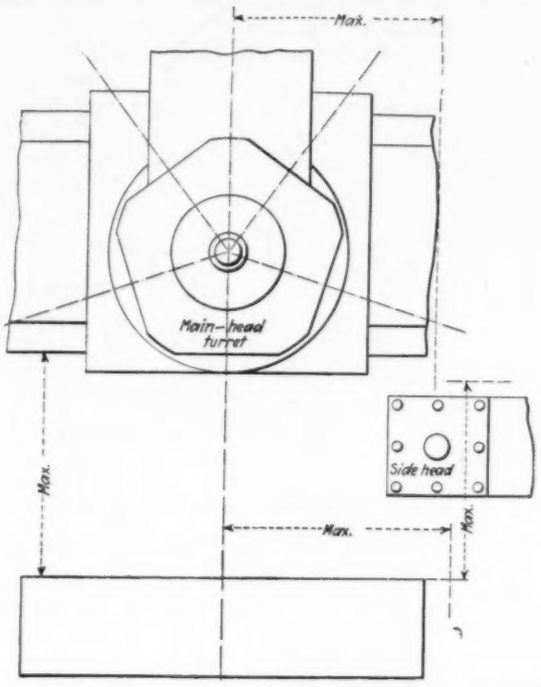


FIG. 406. DIAGRAM FOR TOOL LAYOUTS ON VERTICAL TURRET LATHE

diameter, the tool O being used for the purpose. This is a very simple arrangement, but it must be made substantially and carefully fitted to the machine. It also necessitates the removal of the right-hand toolslide in order to cut the slot in which the roller K is held.

The same attachment used for machining a convex surface is shown in Fig. 405, the only difference being in the shape of the form plate. The work A is held by the inside in a set of special jaws B. The work which is to be done is facing the convex surface C, turning the outside diameter D and cutting the groove E. A form plate F is applied to the same brackets that have been shown in the previous illustration, and the roll K is adjusted to suit the conditions. The tool L is constrained to travel in the direction determined by the shape of the plate. While this operation is being done, the left-hand toolslide N is used to turn the outside diameter D with tool P. After the turning has been completed, the grooving tool Q is set in position and the groove E finished.

The various examples which have been given here are sufficient to illustrate the adaptability of vertical turret lathes and vertical boring mills to the machining of spherical surfaces. In addition to the devices illustrated, some of the ideas which have been mentioned under horizontal turret lathe work may in some cases be subject to a certain amount of revision and applied to vertical boring mill work. There are so many cases which require special treatment, that it is not considered advisable to take up here anything more than the simpler methods. Special attachments can, of course, be designed to suit particular cases. One point of importance is that, wherever possible, the attachments should be arranged so that the use of both heads will not be interfered with.

Layouts for Vertical Boring Mills

In laying out tools for machining work on the vertical boring mill and vertical turret lathe, the standard tools which can be purchased with the machine are so adaptable that the tool layouts are considerably simplified. As there are only five sides to the turret there is less likelihood of interference, and the method of setting up the work and applying the tools allows the operator considerable latitude. In making tool layouts for the machines mentioned, a simple diagram like that shown in Fig. 406 will be found of great help. This diagram should be made in ink on tracing cloth, and should contain about as much information as seems to be essential for making a correct layout. The table diameter and the maximum movements of turret and sidehead should be clearly shown. With this diagram as a guide, when it becomes necessary to make a layout the tools and toolholders can be easily placed in position, and the various operations indicated in such a way that they will be easily understood.

The first and second settings of a large cast-iron spider which is machined on a vertical turret lathe are shown in Figs. 407 and 408. All of the tools used for the operations are of a standard nature, and it is considered advisable to show these two settings in order

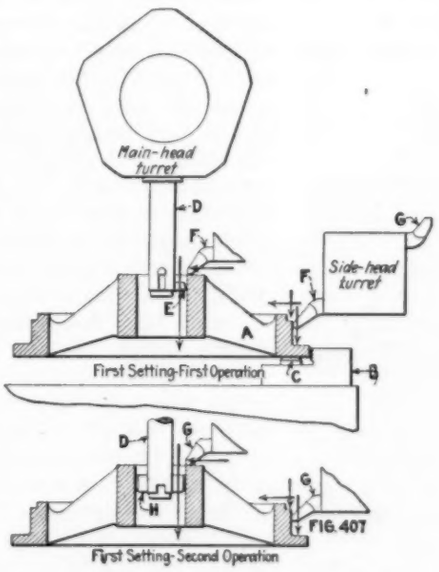


FIG. 407. TOOL LAYOUT USING STANDARD EQUIPMENT

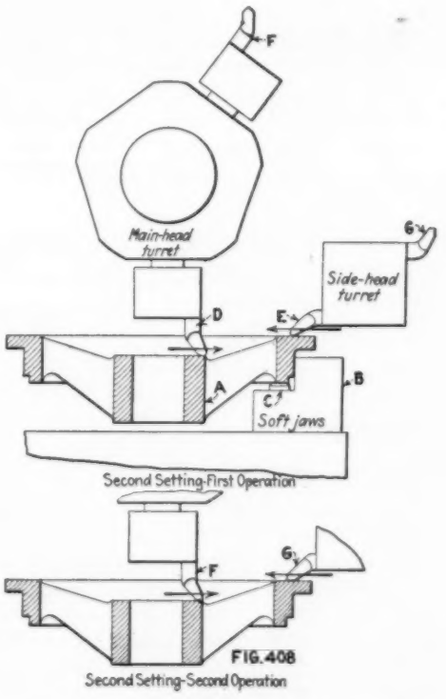


FIG. 408. SECOND SETTING LAYOUT WITH STANDARD TOOLS

to illustrate the adaptability of the machine to work of this character. The work *A* is held in standard jaws by the outside diameter and it rests upon hardened buttons *C*. The main head carries a standard type of boring bar *D*, in which tools *E* are used for rough- and finish-boring. The sidehead contains a tool *F*, which is used to face the hub and turn and face the other surfaces indicated by the arrows.

The sidehead and main head are working simultaneously. After the rough- and finish-boring operations have been done, the floating reamer blade *H* is placed in position in the bar *D* and the reaming cut taken, while the tool *G* in the sidehead is used to finish the same surfaces which were roughed in the first operation.

The second setting is shown in Fig. 408. The work is held by the outside in soft jaws *B*, which are bored out on the machine to fit the outside surface finished in a previous operation. The work is supported on hardened buttons *C* in the chuck jaws. The tool *D* in a standard holder in the main-head turret is used for roughing off the surface of the hub, a longitudinal feed causing the tool to travel in the direction indicated by the arrow. At the same time the tool *E* in the sidehead turret faces the flange, as shown by the arrow.

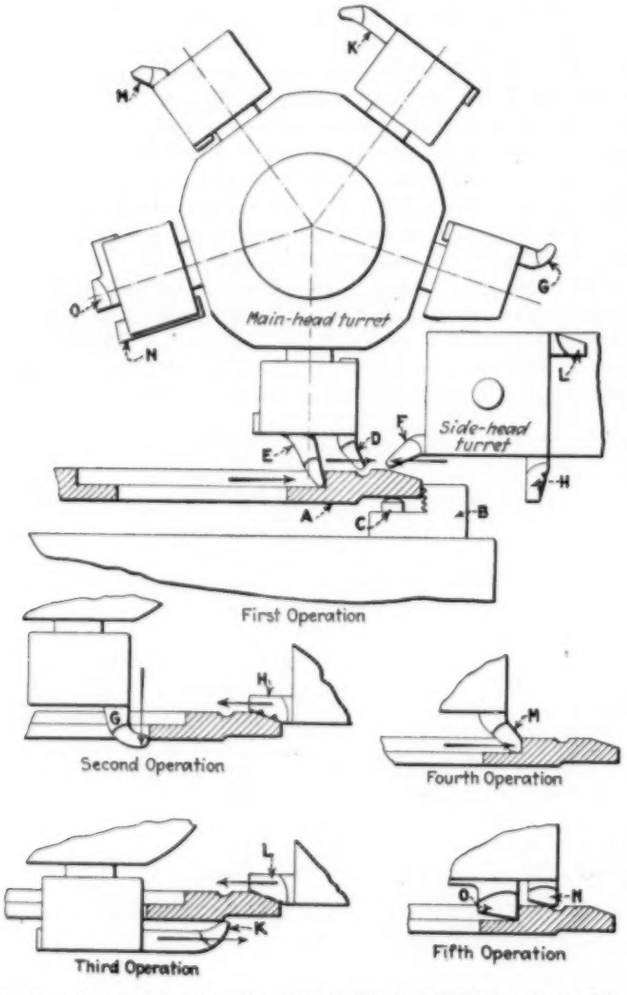


FIG. 409. TOOL LAYOUT FOR FIRST SETTING OF CAST-IRON DISK ON VERTICAL TURRET LATHE

For the second operation, the tool *F* in the main-head turret and tool *G* in the sidehead turret are used for finishing the same surfaces. This completes the work, and it will be seen that practically all of the tooling is of a standard nature. It can further be noted that both the main-head and sidehead tools are working simultaneously and practically all of the time, which makes the production rapid.

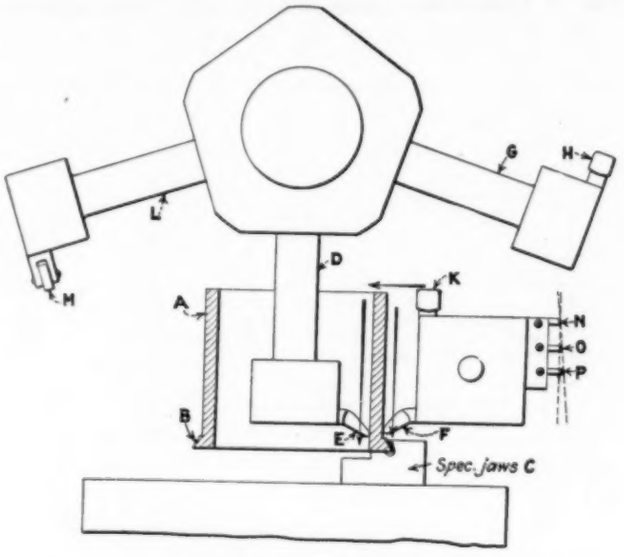


FIG. 410. TOOL LAYOUT FOR PISTON-RING POT

We have several times mentioned the importance of keeping as many tools in operation at the same time as possible, in order to obtain maximum efficiency. This matter is exemplified on vertical turret lathe work, and the greatest care should be taken to make sure that the sidehead and main-head turrets are working continuously, so far as the nature of the work will permit. At the same time, it is often not necessary to go to great expense in regard to the tool set ups, but it does require that the engineer who makes the layout should be thoroughly familiar with the machines and their movements if maximum production is to be obtained.

Holding a Large Piece

In Fig. 409 is shown a piece of work *A* which has a diameter of 26 in. and which is to be machined on the various surfaces indicated in the illustration. The work is held by the outside in chuck jaws *B* and supported on hardened buttons *C*. The tool equipment used is very simple, and for a great part of the diameter both the sidehead and main-head turrets are working simultaneously. In the first operation a standard toolholder carries tools *D* and *E*, which are used for rough-facing the surfaces indicated by the arrows. The turret is fed in a horizontal direction to produce this result. The tool *F* held in the sidehead turret is at the same time fed inward in order to rough-face the surface shown.

In the second operation, the tool *G* is used for rough-boring the large hole, and the tool *H* in the sidehead turret is brought forward to rough-face the angular surface. The tool used here is nickeled, in order to break up the chip and make the cutting action easier. In the third operation, the tool *K* is of exceptional length, but it is held in a standard toolholder as indicated. The main-head turret is fed down to a predetermined distance and the tool *K* is used to undercut the surface shown. Only one roughing cut is taken on

this surface. While this undercut is going on, the tool *L* in the sidehead turret is used for finishing the angular surface.

In the fourth operation the tool *M* finishes the shouldered portion of the work, leaving a small amount for a final sizing cut. The final finishing operation is done in the fifth operation by the tools *N* and *O*, these being so set that they will retain the shoulder distance, which is important.

The second setting of this piece is not shown, but it is very simple, and some of the same tools can be used that are shown in this illustration. The work is turned over and located on the finished shoulder on a special fixture of simple design. The outside diameter is then turned by the sidehead and the facing cuts done by the main head. No extra tools are necessary for this operation.

Layout for Piston-Ring Pot

The work shown at *A* in Fig. 410 is a cast-iron ring pot of special form from which large packing rings are made and cut off. The tool required for such a piece of work is comparatively simple, yet the operation is somewhat different from any which have been previously described. In the first place, the lower portion of the casting *B* is made somewhat heavier than the remainder of the pot, and it is beveled as shown so that it can be firmly held in the special jaws *C*, which are cut to a corresponding angle. As this work is of 12-in. diameter and as the walls of the casting are rather thin, care is necessary in the cutting to make sure that excessive vibration is not set up by the tools. In order to prevent this vibration a special toolholder *D* is used in the main head, and it carries a boring tool *E* which works directly opposite a turning tool *F* in the sidehead. This method of machining tends to reduce vibration and greatly facilitates the cutting action.

The finishing of the outside and inside diameters is accomplished in the same manner by means of the holder *G* and tool *H* in the main-head turret, working in opposition to a finishing tool *K* in the sidehead. After these two operations have been completed, the holder *L* is indexed into position and the roll *M* brought into contact with the inside of the ring pot.

The three tools *N*, *O* and *P* in the sidehead are now used for cutting off the ring, and the support furnished by the roll *M* is of value in order to prevent chatter. The parting tools mentioned are set progressively, so that *P* is slightly ahead of *O* and *O* is ahead of *N*. By this means the rings are cut off one at a time and the operator stops the machine and removes each ring as fast as it is made. It is possible to use more parting tools if desired, but it has been found that greater satisfaction is obtained by using two or three tools than by attempting to cut all the rings at one time. It is obvious that the roll *M* must be moved downward into a suitable position for giving support, according to the position of the sidehead tools.

We have attempted to cover in a concise and graphic manner the field of manufacture to which the vertical turret lathe is adapted, but the tool engineer will appreciate the fact that many of the matters which have been dealt with in horizontal turret-lathe tooling are applicable to the methods for the vertical turret lathe. For this reason it has been our endeavor to simplify the examples given as far as possible, in order to avoid any repetition of principles which have been previously treated.

Does Forced Lubrication Score Bearings?

By Theodore H. Miller
Works Manager, DeLaval Separator Co.

I have read with a great deal of interest the article on page 919, Vol. 56, of *American Machinist*, entitled "Does Forced Lubrication Score Bearings?" Mr. Hudson has evidently hit upon a kind of apparatus where direct comparison between the splash and forced lubrication can easily be made.

The scoring of the crankshaft, which he brings out, was new to me; not so, however, the very great difficulty which is being experienced with the oil used in the gear cases on large steam turbine installations and in crankcases of Diesel and other heavy oil engines. For these services, it was found out sometime ago that a means of purifying the oil constantly is not only a very great saving in oil, but very materially reduces repairs and most important of all, tends to insure continuity of operation. As an example of this importance, one of the very large public service corporations not far from New York had one of its largest steam-turbine driven units out of commission for three days, when it was very badly needed, on account of dirty oil. This was the final wedge which resulted in the installation of a centrifugal oil purifier to clean the oil. Not only has that machine continued to operate with the aid of the centrifugal purifier, but all of the other many units of that corporation are also fitted with them.

A destroyer making a round trip to Europe during the war and since, has been able to about pay for the installation of a centrifugal machine through the oil saved alone, to say nothing of the reduced wear on the power plant. It was formerly the practice to use the oil as long as it was thought safe, then to pump it overboard and fill up with fresh oil. The centrifugal purification system by-passes a portion of the oil in use through the purifier all the time, thus keeping it at all times in prime, usable shape. These machines are now installed, or in process of being installed on all the vessels of the Navy and most of the merchant marine.

Cutting oils used in manufacturing establishments are purified to such an extent as to keep them in almost new condition and very greatly prolong the life of the cutting tools. Perhaps the editor had all of these things in mind when writing the very timely editorial which appears on page 939 in the same issue.

The Foreman as "Non-Com"

By A. W. Brown

The "buck private" has learned, or should have learned, both to obey and how to obey, so that when promotion comes, he knows why obedience is not merely good policy but absolutely essential, and can better command, and better explain, why obedience is necessary and why certain orders are issued.

As "non-com" he has not forgotten his "rookie" days; nor does he forget that the ex-rookie, now "non-com," may aspire with due confidence to exchanging his chevrons for the bars of a "shave-tail." He has mingled on equal terms with all sorts and conditions of men and knows the inner workings of their minds. He remembers, perhaps, injustices that he would be wise to avoid and bears in mind advice and examples that have stimulated him and his colleagues to increased and well-directed effort. He can avoid, or at least strive to avoid, his predecessors errors.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

How the Disk Is Machined

BY MILTON WRIGHT

On page 959, Vol. 54, of *American Machinist*, P. Arter asked the question "How would you machine this disk?"; and at intervals throughout the succeeding volume there appeared various contributions offering advice and suggestions as to methods and tools for performing the job.

The job cited was the machining all over (except the periphery) of disks of cast brass 22$\frac{3}{16}$ in. outside diameter and of different thicknesses, ranging from $\frac{3}{16}$ in. to 0.070 in. Six 5$\frac{21}{64}$-in. holes equally spaced about the center at a radial distance of 8 in., were to be bored and threaded to a diameter of 5$\frac{1}{2}$ in., having a 24 pitch V-thread.

A hub on one side of the disk was 9$\frac{1}{2}$ in. in diameter with a total thickness, including the web of the disk, of $\frac{3}{4}$ inch.

There were various holes to be drilled and slots to be cut in each disk, but these were minor details and a subject only for ordinary jig designing; the real problem was to face the disks on both sides so as to leave them flat and parallel, and to hold them for subsequent drilling and threading of the dial holes without again distorting them. This latter operation also called for some consideration, as the bushings which were later to be screwed into the threaded holes must stand square with the face of the disk and present smooth faces flush with the web on both sides. On the thinner disks there could be but little more than one turn of thread in the hole.

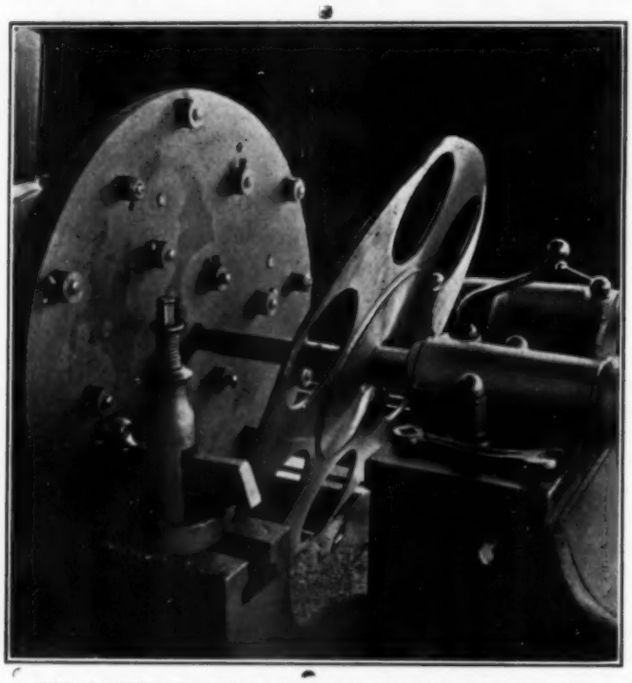


FIG. 1—THE FACEPLATE UPON WHICH THE LATHE WORK IS DONE

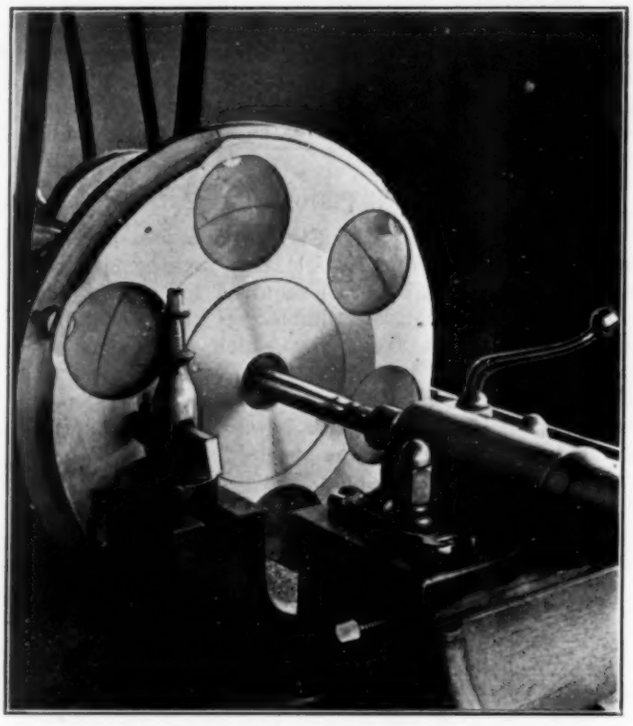


FIG. 2—THE DISK MOUNTED IN THE LATHE FOR FACING

This job has been and is still a standard manufacturing operation in the shops of the Persons-Arter Machine Co., of Worcester, Mass., where the present writer had the privilege of seeing and photographing it.

In Fig. 1 may be seen the special faceplate upon which all the lathe work is done. This is a parallel disk of cast iron permanently bolted to the regular faceplate of the lathe and fitted with a number of freely moving plungers, each plunger having behind it a coil spring and each being fitted with a collar that may be tightened upon it by means of a setscrew.

METHOD OF HOLDING THE WORK

Two of the projections that may be seen in the picture are permanent bushings set into the faceplate, and a third similar bushing is concealed from view by the toolblock. These three bushings are faced off after assembling and together form a three point bearing against which the disk to be machined is held by means of standard hexagon head machine screws passing through from the back of the plate.

The first machine work upon the disk casting is to drill and tap the holes for the holding screws. As these holes must not only come in the right place to match the screws but must also be very exactly spaced so that the three screws will enter freely from either side, the drilling and tapping is done in a jig.

With the setscrews in all the collars loosened the disk is then fastened to the faceplate as in Fig. 2 by means of the screws, the spring plungers moving back as the pressure comes upon them but remaining always in firm contact with the disk regardless of any irregularity in the casting. When the holding screws are all tight the lathe is turned over to see that everything is all right and then the collars are tightened upon the plungers.

As each collar lies against the surface of the plate the disk is now suported against deflection due to tool pressure at a sufficient number of points to insure that a cut taken over the outer surface will leave it flat, except for the slight warping due to the removal of the scale. In this position the entire exposed surface is machined, including the hub.

The disk is then turned over and again fastened with the newly machined surface toward the plate, the setscrews in the collars being loosened so that the plungers will bear upon the work only by the pressure of their springs. Having secured the disk to the plate, the setscrews are again tightened to present a rigid backing to the work.

In this way the bearing against which the work rests is always made firm and unyielding so that, were it not for the natural distortion of the casting due to the removal of scale, but one cut over each side would be needed to make it flat and parallel. Because of the distortion, however, two cuts, and sometimes on the thinner disks three or more cuts, over each side are required to produce the desired condition.

The arbor shown in the foregoing pictures does not seem to be a necessary part of the set-up, but as a matter of fact it is quite an important one, for without it the lathe spindle would have a slight amount of end movement that would result in a wavy or "chattered" surface. With the arbor between centers all end movement of the spindle is taken out toward the thrust bearing and a smooth surface is obtained on the work. This dodge is an old one and well known to all lathesmen who have much facing to do.

Boring and threading the six dial holes is done under a radial drill press and in Fig. 3 is shown the equipment necessary. The jig plate *A*, bolted to the top of the drill press table, has at its center a shouldered stud over which the center hole in the disk (bored while the casting is still in the lathe) fits. At the correct radial distance from this stud a hole through the plate accommodates a slip bushing which is held in place by a setscrew.

Two bushings are provided, one having a plain hole and the other threaded internally with a 24-pitch thread to correspond to the thread to be cut in the disk. Likewise two boring bars are provided, one with a plain pilot to fit the plain bushing and the other with a threaded pilot to fit the threaded bushing.

The disk shown in Fig. 3 is a finished piece of work laid upon the jig for the purpose of photographing. It will be noted that there is at one side of each of the six dial holes a steel finger lying in a radial slot extending from one side of the dial hole toward the center of the disk. At the time when the work would in regular course of procedure come to this operation, the fingers would not be in place but the slots would be there, having been milled in an indexing fixture in a previous operation.

As the brass disk lies in position upon the jig it rests at its center upon the shoulder of the stud and is further supported at one side, under the hole to be machined, by a ring of cast iron having an internal diameter somewhat larger than the hole in the work. Having located the hole to be threaded by its respective radial slot, a similar ring is now laid on the disk surrounding the hole and is clamped in place by bolts and straps as shown.

With the plain bushing in the jig plate and the bar with the boring cutter in place in the spindle of the machine, the method of boring is obvious. Substituting the bar with the threaded pilot, which bar carries a chaser instead of a boring tool, and setting the threaded bushing in place of the plain one the operation of threading becomes quite as simple. In Fig. 3 it is the threading tools that are shown. From the position occupied by them in the picture it is necessary only to run the spindle down until the bushing is seated in the jig plate, tighten the setscrew, and start the machine.

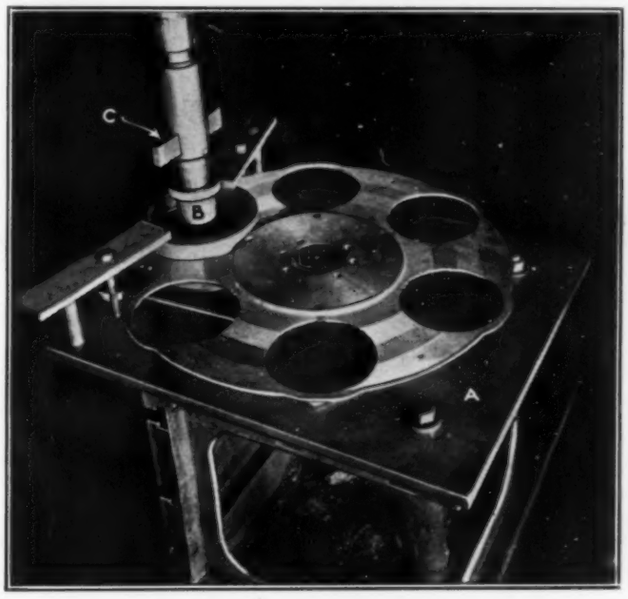


FIG. 3—THE SET-UP FOR BORING AND THREADING THE DIAL HOLES

The threaded bushing *B* is first screwed two or three turns onto the pilot of the bar. When the spindle is brought down to seat the bushing the chaser *C* is almost at the starting point of the thread. All feeds and operating levers are thrown out and the spindle is free to follow the guidance of the pilot in the threaded bushing. A half dozen turns of the spindle and the work is done.

The chaser does not have to be "unscrewed" from the work. It cuts at one end only and when its work is done the holding straps are released and the disk turned slightly to one side to clear the longer end of the chaser.

Quick-Acting Monkey Wrench

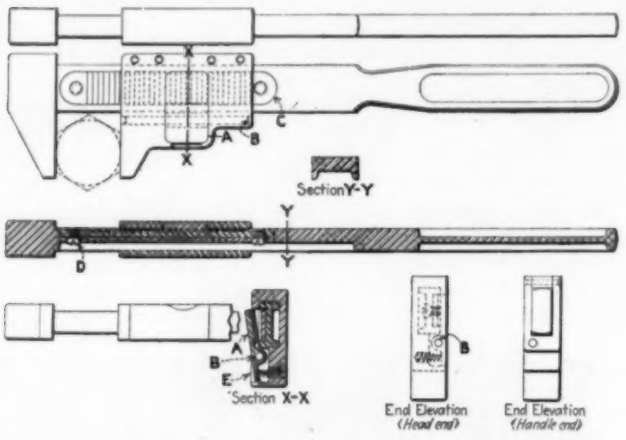
By Raymond Beckman

The sketch herewith shows a wrench that was designed and made by the writer for use in our own shop. It was so well liked by everyone who used it, and has proved such a success that I felt it my duty to present it to readers of *American Machinist* in return for the many splendid ideas that I have gotten from that magazine.

The advantages of this wrench are that it is quick-

acting in adjustment, positive, extra strong for its weight, stays put and fits the nut perfectly.

The body is similar to that of the conventional monkey wrench. At *A* is a spring-actuated pawl mounted on the movable jaw and pivoted on pin *B* which is a



QUICK-ACTING MONKEY WRENCH

press fit in the jaw. A hardened tool steel rack *C* is let down into the body and held in place by screws at *D*. The rack teeth are sixteen to the inch for the reason that every nut progresses in size across the flats in steps of $\frac{1}{16}$ in. or multiples thereof. This makes the wrench fit every nut with a full bearing across the flats and not on the corners of the nut. To adjust the movable jaw push down on pawl with thumb at *E*, disengaging the pawl from the rack and the jaw can be pushed up or down.

While the cost of making this wrench was rather high in the small quantity made, the work was done during the recent business depression.

Tools for Blanking and Piercing Watch Wheels

BY I. BERNARD BLACK

In modern die construction the old cylinder sub-press is fast being replaced by the pillar type of sub-press. There has been considerable discussion as to the relative merits of the two types and many old-time diemakers are not favorably disposed toward the pillar housing, claiming that it is not as accurate as the cylinder sub-press; but the writer has had much experience in designing dies to be used in pillar sub-press housings and finds them to work better, to be more accurate, and cheaper to make, due to the fact that no relining of the housing is ever necessary and it can be used over and over again as often as new tools are designed for similar jobs.

In the illustration, Fig. 1, is shown a set of tools designed to produce the watch wheel shown in Fig. 2. The material of which this wheel is made is Bessemer steel 0.026 in. thick, and the wheels are blanked complete with teeth and centerhole from 10-ft. lengths of stock $\frac{3}{4}$ in. wide. In designing this die the pillar type of construction was chosen as being more universal than a sub-press.

The operation of the die is as follows: On the downward stroke of the ram the die *A* forces down the stripper *B*, allowing the punch *C* to enter the die, blanking the periphery of the wheel. At the moment of blanking, the shedder *D* is pushed back and the punch *E*, being rigidly re-enforced by a hardened steel stop-plate, pierces the center hole, the piercing passing out through the hole in the blanking punch *C* which also constitutes the piercing die.

At the end of the stroke the blank is pushed entirely clear of the stock and is lodged in the die *A*, but as the ram recedes, the powerful spring that backs up the shedder pushes the blank back into the stock from whence it was cut so that when the stock issues from the die it is to all appearances as solid as when it went in, except for the small center hole.

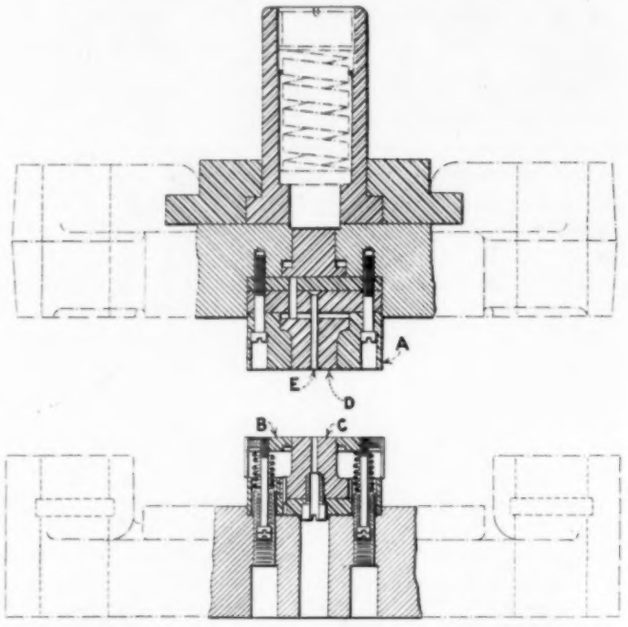


FIG. 1. PILLAR PRESS TOOLS FOR BLANKING A WATCH WHEEL

In Fig. 3 is shown a plan of the tools. It will be noticed that two stops are used. In order to get accurate work and at the same time make the tools foolproof, the stop *F* is used when feeding the stock by hand until a sufficient number of blanks have been cut for the stock to have reached the automatic stop *G*, when the roll feed is thrown in.

On the second stroke of the press the stock is pulled over the stop-pin *H* in the stop-bar *F* and after the fourth stroke, at which time the stock has reached the automatic stop *G*, stop *F* is pulled back and locked.

The automatic stop, shown in Fig. 4, is of the

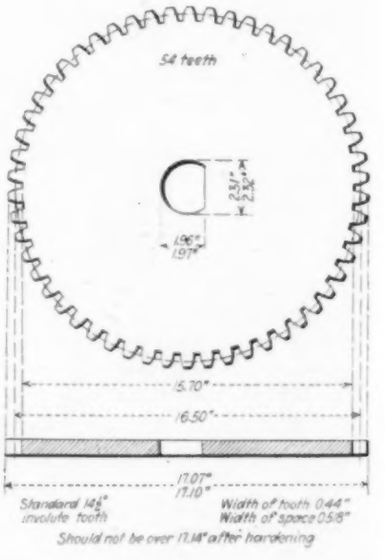


FIG. 2. THE WHEEL TO BE BLANKED

trigger type with a projecting end to be operated by the adjustable striking screw in the die plate. As the die descends this screw strikes the end of the trigger, lifting the opposite end of the stop out of the way of the stock.

It has been mentioned that the blank is replaced in the stock so neatly that the outline of the cut is hardly

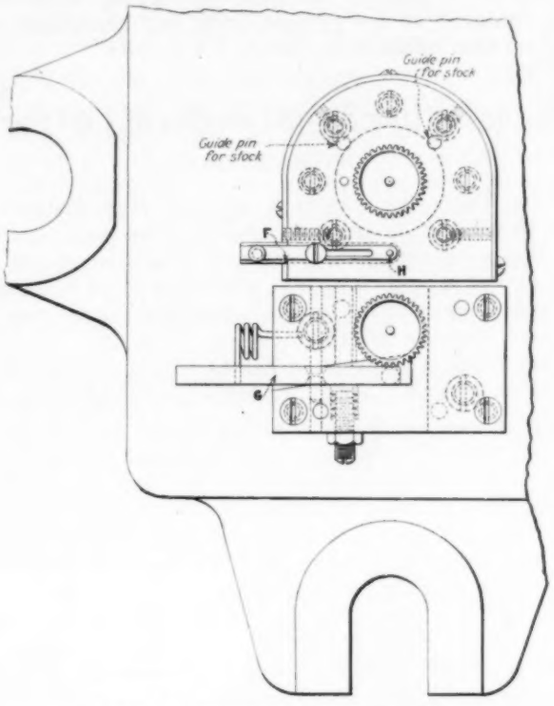


FIG. 3. ELEVATION OF TOOLS

discernible. To remove it from the stock, a second punch and die, known as the "knockout" is located at the required distance from the blanking die. The knockout punch is, however, made 5 mm. smaller than the blanking punch, and the die a corresponding amount larger than the blanking die.

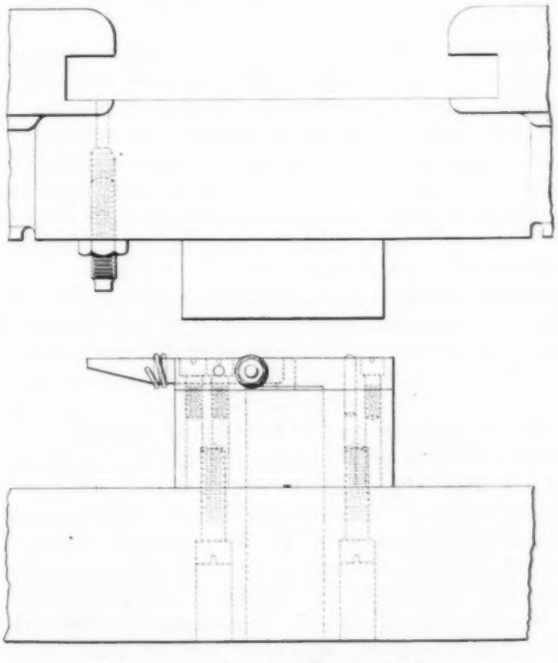


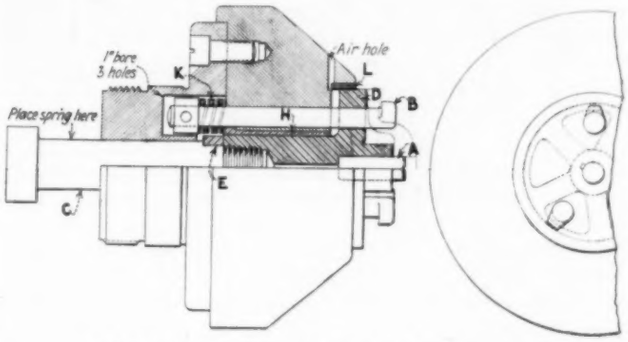
FIG. 4. THE AUTOMATIC STOP

A Special Screw-Machine Chuck

BY EDWARD H. TINGLEY

The special screw-machine chuck shown in the illustration has been successfully used to simplify the chucking of circular work, and accomplishes the same result as any reversing mechanism for a collet closing plunger. It can also be applied to any work that has to be clamped against a pad or faceplate on a hand screw-machine and which requires that work be located on a stud. It is simple and quick in operation and results in accurate work.

The operation of the fixture is as follows: Place the casting to be machined on stud *A* and with the



SPECIAL CHUCK FOR A SCREW MACHINE

fingers turn the hook bolts *B* a quarter turn. Pull the collet-closing plunger to push spindle *C* forward carrying with it parts *D*, *A* and *E*. The forward motion is continued until collar *E* stops against the head of bushing *H* thus clamping the work between the hook bolts and the face of *D*, under tension of the spring *K*. The collar *E*, stopping against the bushing *H* locates the work in the same position each time. Bushings *L* and *H* act as guides for pad *D*. An air hole is bored back of pad *D* to allow air to escape as it moves back and forth.

Slotting Tool Steel Cylinders Without a Cutting Tool

BY I. B. RICH

There is perhaps nothing in the line of mechanical work which gives more opportunity for personal skill than the use of flame or electric welding apparatus. Here the difference between a good job and a poor one, assuming of course that the apparatus is O. K., depends almost entirely on the individuality of the operator.

One of the latest developments is that of accurate cutting, the usual cutting operations hardly coming under this heading. An excellent example of this is to be seen in the plant of the Western Tool and Manufacturing Co., Springfield, Ohio, as shown herewith.

An Oxweld torch is fastened to the overarm of an old milling machine so that the tip or nozzle points vertically downward as in Fig. 1. The cylinder to be cut forms the barrel or sleeve of the expanding mandrel and is mounted in a holder so as to index the sleeve to line up with the holes previously drilled. The milling machine table provides the feed, which is hand operated.

The proper flame, and here the skill of the operator comes into play, cuts a slot $\frac{1}{8}$ in. wide and as straight as the table guides the work. The slots are clean, straight, radial and of uniform width. And the cutting

speed is about three times that of milling without the trouble and expense of cutter breakage. The sleeve is shown in Fig. 2.

The slots vary in length up to 8 or 10 in. and the metal is from $\frac{3}{8}$ to $\frac{3}{4}$ in. in thickness. The steel is about

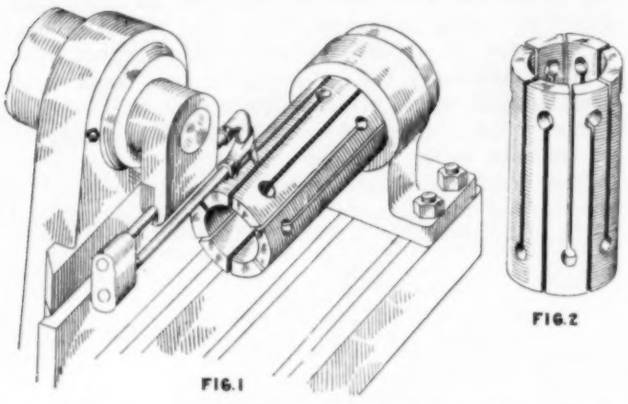


FIG. 1. CUTTING NARROW SLOTS WITH A FLAME. FIG. 2. THE SLEEVE IN WHICH SLOTS ARE CUT

70 point carbon and is afterward hardened and drawn to a spring temper. An adaptation of this should prove of great value in roughing out cutting and blanking dies instead of drilling the outline as is the usual method. This would leave a cleaner job and be much faster. It requires a skilled operator but this is simply a challenge to those who desire to get ahead in the work.

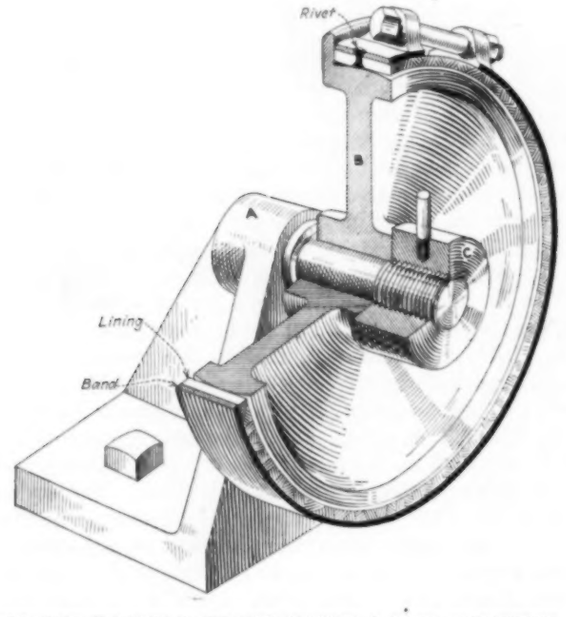
Device to Hold Brake Bands for Relining

BY O. S. GHIGLIA

Some time ago I had occasion to re-line the brake bands of my Ford car and, having difficulty in holding the work and riveting at the same time, I built the fixture illustrated and described herewith. With this device the work of riveting on the brake lining is relieved of many of its tedious and disagreeable features.

Into the upper part of the face of a suitable angle plate *A*, I screwed a shouldered stud having a thread on each end, and to the central part of this stud I fitted a drum of cast iron *B* of proper size to hold the work. A nut *C* with a pin handle, screwed on the outer end of the stud, enables me to clamp the drum in any position, and thus have the particular rivet upon which I am working at all times on top where it is easy to get at.

The device may be bolted on the edge of the bench, to the studding of the garage, or to any convenient projection that offers.



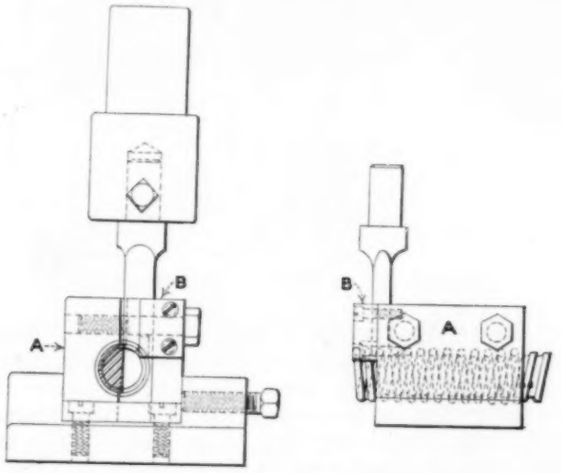
DEVICE TO HOLD BRAKE BANDS WHEN RELINING

Die for Cutting Short Lengths of Coil Spring

BY H. M. FAY

The illustration shows a die that was designed to cut short lengths from previously coiled wire springs. In this case only two turns were required in the cut spring but it is obvious that the device could be adapted to cut other lengths by providing a suitable stop for determining the length.

The block *A* is made in halves and held together by suitable screws. After assembling it is bored and



TOOLS FOR CUTTING COILED WIRE SPRINGS

threaded to fit the coil with a round section thread of a depth equal to a little more than half the wire diameter and of a pitch to match that of the spring. An arbor, similarly threaded to correspond with the internal diameter of the spring, is tightly clamped in the block in such a position that when assembled there is a helical groove or passage clear through the combined piece, through which the spring may be "screwed" in the operation of feeding.

A small plate *B* attached by screws to the block, forms a stop against which the end of the wire is fed, and also acts as a guide or backing for the punch. At the end of the threaded arbor that comes under the punch one half of its diameter is cut away so that it becomes the die against which the cut is made.

The outer end of the arbor is allowed to protrude some distance beyond the block, and thus enables the operator to start a coil easily by simply screwing it onto the half thread. As the shortened coil passes into the block and out of sight of the operator, a new coil is screwed on and serves to push the shorter one through the die, cutting off as it is fed along, so there is no loss of material except perhaps a part of a turn of each coil.

Editorial

Training and Rewarding the All-Round Mechanic

DURING the slack period from which we are fortunately emerging, there seemed little need of thinking of apprenticeship or of training men. But almost the first increase in demand shows that highly skilled men are scarce and even the semi-skilled none too plentiful. Realizing the constant need of trained men, the apprenticeship committee of the National Metal Trades Association, after devoting much time and thought to the subject, has issued a most instructive report on apprenticeship, primarily for its members, but obtainable by others as well.

The report recognizes that while many shop operations can be performed by comparatively unskilled men, or men with little training, the all-round mechanic is, and always will be necessary in production. The problem of how to train such men from promising boys with more or less educational foundation is taken up earnestly, practically and with much breadth of vision.

There is also another side to the problem of the all-round mechanic—that of so utilizing his knowledge and experience as to enable him to be paid in proportion to his value. In too many cases we find a man with a thorough fundamental knowledge of machine work, a man who can be depended on in an emergency, earning less money than a specially rapid machine operator with very little training.

It is not an easy matter to handle such a problem. The specialist operator produces a given number of pieces per day and we have tangible evidence of his value. The all-round mechanic might not be able to produce as many pieces even if we wanted to put him at the job. His value lies in a different phase of manufacturing and unfortunately one that is less tangible. But unless this value can be realized and paid for, what inducement is there for a boy to spend four years in acquiring the necessary training?

Promises of future advancement, of foremanships and other possible paths to larger incomes, lose their attractiveness if long deferred. In these days of high rents and living costs, the young man of domestic tendencies is obliged to consider immediate as well as future returns. And in order to secure the best class of boys, who will make the most desirable and dependable all-round mechanics, it is more than ever necessary to consider what the trade holds out for him in the near future. If we consider such men necessary and desirable, we may have to count on other qualifications as well as ability to produce.

Dependability and interest in the work and welfare of the company have a real value, even though it cannot be designated easily in dollars and cents. We perhaps need some new standards of value for such service, standards that will enable us to measure more than the actual work performed, in cases where previous training and experience make a man available for unusual or especially valuable work at a moment's notice. We need the all-round man; let us find some way of rewarding him so as to attract the best men to such work.

Co-operation Between Colleges and Industry

THE question of the engineering school's relation to industry has come to the front once more, this time in a resolution by the National Industrial Conference Board for the consideration of present engineering education in colleges and universities and for suggested improvements relating thereto. The conference emphasized the fact that the nation's development depends largely on the character and efficiency of the engineers turned out by the various schools, as industry requires technical experts and engineering managers in all its many branches. To secure the best type of graduate engineers requires the development of thoroughly competent men as instructors in engineering schools.

It has long been held by many that there must be close co-operation between engineering schools and industry of all kinds. With this in view it is believed that adequate methods must be developed so that each may help the other in securing better trained graduate engineers. This involves, however, many things which do not appear on the surface, such as better remuneration for teachers in engineering colleges and more encouragement to graduates after they leave college.

Perhaps the best real co-operation between colleges and industry is that worked out by Dr. Schneider in Cincinnati. It is not only good for the boys but it gives the manufacturers a good idea of the value of college training, which many of them lack. They have an opportunity to see how such training helps in making the kind of men they need.

The colleges must have instructors who keep in touch with industry and who do not let graduates go out with false ideas of their importance. Industries on the other hand must co-operate with colleges by telling them the qualifications they require, they must aid the colleges to give practical instruction by furnishing data from their own plants, and they must offer suitable inducements to young engineers of the right sort. They must not forget that the young men have invested several thousand dollars in an education which can be of value to the industry and that this must be capitalized.

Nor is this all. There is an increasing feeling on the part of engineers that they have not received and are not now receiving their share of the earnings from the industries which they make possible, or manage. There are too many cases of absentee directorship, which dictates policies that make it impossible to secure the best results. Banker control of industries has rarely proved satisfactory even to the bankers, and for some reason or other, the banker seems to have the faculty of picking the wrong man to manage a mechanical plant, as shown many times during the war.

If the industry of the country is to receive the greatest value from the engineers which are turned out by the colleges, there must be a better understanding between the financial and the engineering interests than now exists. Colleges must be alive to the newer phases of these relationships and must teach more economics and management to engineering students.

Shop Equipment News

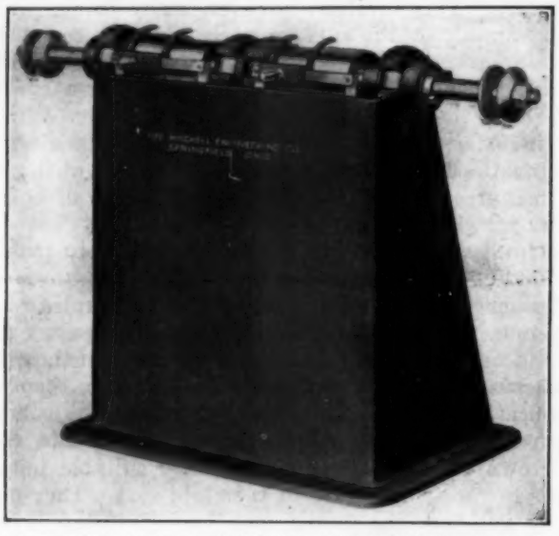
Mitchell Ball Bearing Polishing and Buffing Lathes

The Mitchell Engineering Co., Springfield, Ohio, has recently brought out a line of polishing and buffing lathes equipped with ball bearings.

The No. 5 machine, illustrated herewith, has two independent spindles, while the No. 6 machine has a single spindle arranged for carrying wheels at both ends.

In the case of the No. 5 machine, either spindle can be started or stopped independently of the other. Either or both spindles, together with the bearings can be removed by releasing the bearing-housing clamps and can be replaced without danger of disturbing the alignment as the bearing housings are ball and socket type.

Both machines can be driven either from overhead or underneath and, in addition, the No. 5 machine can be furnished with motor drive, the motor being placed in the base and belted to the spindles. The independent starting and stopping of the spindles is taken care of



MITCHELL NO. 5 POLISHING AND BUFFING LATHE

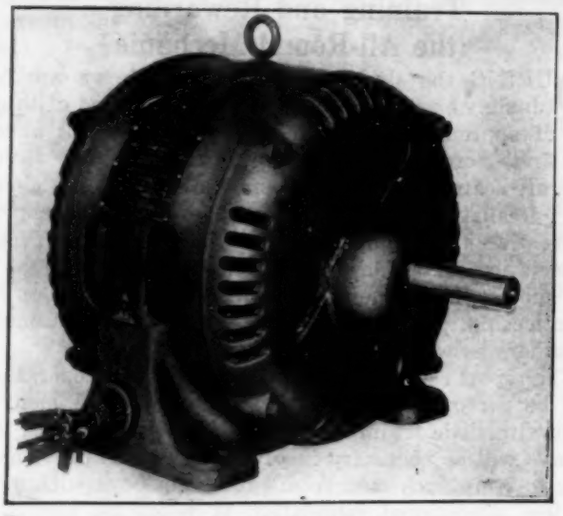
by a belt-tightening device operated by a hand lever.

Specifications of No. 5 machine: Length of each spindle, 32 in. Overall length of both spindles, 66 in. Diameter of spindles in bearings, 2 in. Height from floor to center of spindles, 38 in. Size of base at floor, 26 x 42 in. Net weight, 950 lb. Crated for domestic shipment 1,100 pounds.

Specifications of No. 6 machine: Overall length of spindle, 48 in. Diameter of spindle in bearings, 2 in. Height from floor to center of spindle, 38 in. Size of base at floor, 20 x 26 in. Net weight 600 lb. Crated for domestic shipment 675 pounds.

Watson A.C. Multi-Speed Motors

The Mechanical Appliance Co., Milwaukee, Wisconsin, has recently placed on the market a line of a.c. multi-speed motors, one of which is shown in the accompanying illustration.



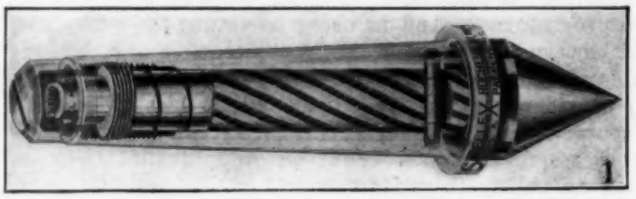
WATSON A.C. MULTI-SPEED MOTOR

The motors have speed ranges of 600, 720, 900 and 1,200 r.p.m. on 60-cycle circuits. Motors will be furnished for constant horsepower, constant torque or any required combination of both in two, three or four speeds, selected from 600, 720, 990, 1,200 and 1,800 r.p.m. either for circuits of 60 cycles or other frequencies and of either two or three phase.

A control apparatus can be supplied which the maker claims has been thoroughly worked out and is suitable for both automatic and remote control.

Snellex Automatic Centers

The Snellex Manufacturing Co., Rochester, N. Y., has recently placed on the market the anti-expansion center for use in lathe and grinding machine headstocks as shown in Fig. 1. The shank of the center proper is milled with a series of helical oil grooves and has longitudinal motion within the tapered case. This motion is opposed by a very stiff adjustable spring, the purpose of which is to allow the center to recede within



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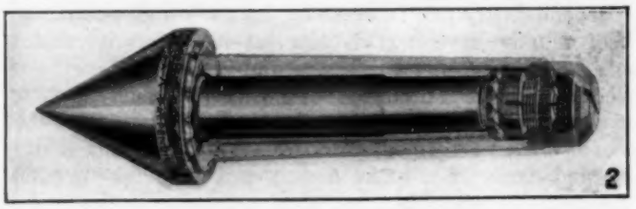


2

FIG. 1—SNELLEX ANTI-EXPANSION CENTER. FIG. 2—SNELLEX ANTI-FRICTION CENTER

the case to a limited extent when great pressure, such as the expansion of work under operation takes place. Through this motion, the tailstock center is relieved from excess pressure due to expansion of the work and does not wear so rapidly. Lubricant can be applied through a hole in the adjusting screw.

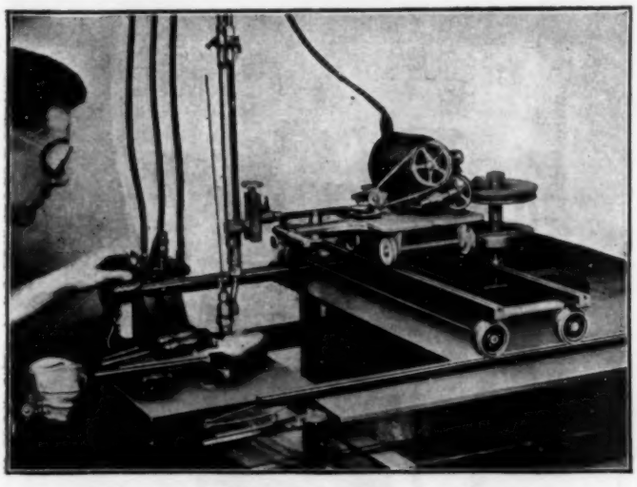
The anti-friction center, Fig. 2, for use in lathe and grinding machine tailstocks either in conjunction with, or separately from the anti-expansion center which was described in an earlier edition of *American Machinist*, is now made with larger balls in the front race.

Centers with Morse tapers from Nos. 1 to 6 are regularly carried in stock. Centers with other tapers and special centers, including centers for pipe and wood work can be furnished to order. Centers for grinding machines have heads of reduced diameter so that the wheel can pass over them in grinding small work.

"GEWE" Automatic Welding Machine

The illustration herewith shows an automatic welding machine that has recently been placed on the market by the General Welding and Equipment Co., Boston, Mass.

The welding rod passes through the center of the torch and is fed downward by gravity. The torch is mounted at one end of a connecting rod that is given motion by a crankpin at the other end. As the connecting rod passes through a pivoted guide, adjustable



"GEWE" AUTOMATIC WELDING MACHINE

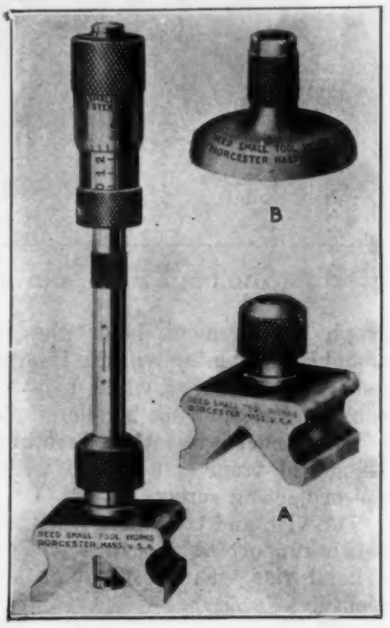
as to position, it will be seen that the torch will travel in an egg shaped path, the proportions of which can be changed, according to the position of the pivoted guide. In addition, the whole machine may be given motion at a right-angle to the mean of the motion imparted to the connecting rod. A combination of these two motions will cause the torch to travel in the path of an approximate cycloid. As the motion of the whole machine can be given more or less amplitude, the torch may be made to travel through a variety of paths.

The combination motion is used in welding a seam. For heavy welds an additional torch is supplied which precedes the welding torch and preheats the metal.

The machine has two speed adjustments, one by means of a friction wheel and disk and the other through a rheostat controlling the motor. By means of the rheostat not only can finer speed adjustments be made but variations of speed can be made at points where the thickness of the metal varies.

Reed Inside Micrometer and Height Gage

The Reed Small Tool Works, Worcester, Mass., has recently developed an inside micrometer having a lower range than the one illustrated on page 388, Vol. 56, of *American Machinist*, the range being from 2 to 7 in. with the five rods furnished. With five additional rods the range can be increased to 32 in.



REED INSIDE MICROMETER AND HEIGHT GAGE

The micrometer is graduated to read to 0.001 in. and the diameters of the barrel and thimble allow for wide spacing of graduation lines and good sized figures.

The tool can be quickly converted into a height gage by use of the attachment shown at *A* and a range of 3 to 32 in. can be attained by using a rod of proper length. The rod is put through the hardened base until the anvil finds the surface from which the measurement is to be taken. A quick-clamping knurled nut, easily operated by the fingers, firmly holds the measuring rod in a perpendicular position. The V-shaped groove in the bottom of the base adapts the tool for use in cylindrical work, measuring distances between shafts and for alignment purposes.

By inserting a drill rod in the base, and attaching any standard indicator the tool can be converted into a surface gage.

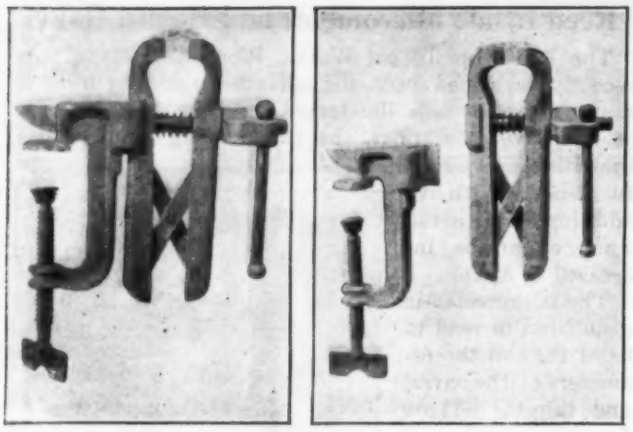
The round base *B* can be used in place of the base *A* when the micrometer is used as a height gage only on plane surfaces. The upper end of the support is split to afford sliding friction as the rod is inserted and tends to prevent looseness should wear take place from constant use.

Combined Hand and Bench Vise

A combined hand and bench vise, designed for the use of toolmakers, patternmakers and others having occasion to manipulate small pieces of work in filing or other operations in which the work cannot be held with sufficient firmness in the grip of the fingers alone, has been placed on the market by the Malleable Iron Fittings Co., Branford, Conn., and is shown in the accompanying illustration.

It is made of semi-steel and is in two main parts. The anvil clamp is to be attached to the edge of the work bench or other convenient point of support and is provided with a tapered dovetail slot into which the vise proper is fitted. To be used as a bench vise the tool has but to be set in place in the slot where it will be held firmly without setscrews or other means of fastening.

The capacity of the vise is 1½ x 1½ in. The panto-



COMBINED HAND AND BENCH VISE

graph arrangement holds the jaws parallel at any amount of opening within its range. Instead of the usual wing nut with which hand vises are provided this one has a sliding pin handle similar to the handle of a regular bench vise; the offset nut allowing the pin to be moved from end to end without interfering with the projecting screw.

The vise and contained work may be lifted from the bench support at any time without effort and used as a hand vise. Either plain or serrated jaws are furnished.

Oilgear Horizontal Press

The accompanying illustration shows a horizontal hydraulic press that has recently been placed on the market by the Oilgear Co., 60 to 64 Twenty-seventh St., Milwaukee, Wisconsin.

The forcing capacity of the press is 25 tons at speeds varying from ¼ to 6 in. per minute. The maximum traversing speed of the ram is 37 in. per minute on the outward stroke and 56 in. per minute on the return stroke. Ram speeds can be instantly changed by the operation of a control handle located on top of the pump. The pump is driven by a constant-speed, 2-hp. electric motor and no accumulator or auxiliary pump is required. Suitable overload relief valves prevent injury in case the ram is driven against a stop at high speed.

The cylinder is 9 in. in diameter and the full capacity

OILGEAR HORIZONTAL PRESS

pressure exerted on the ram piston is 800 lb. per square inch.

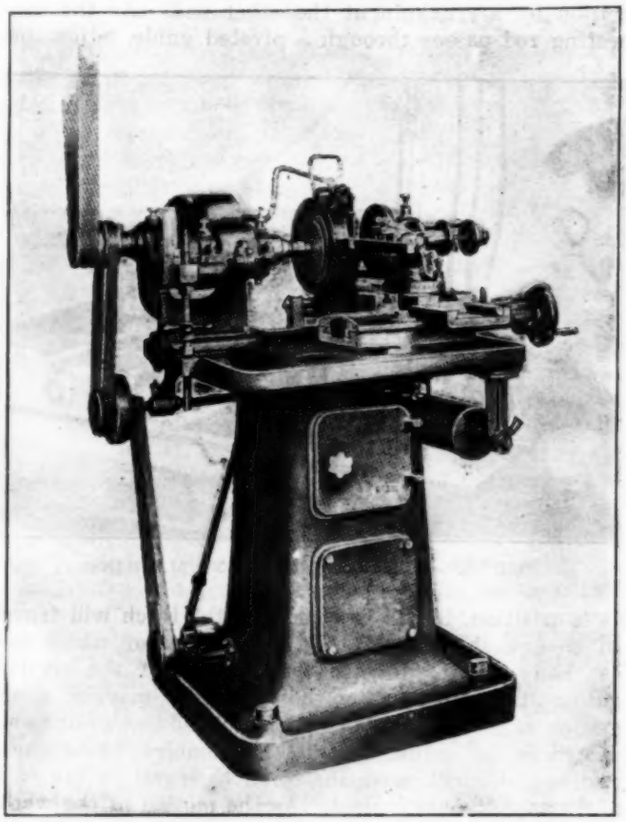
The diameter of the ram is 5¼ in., and the length of the stroke is 30 in. The axis of the ram is 32 in. above the floor and the distance between the stop supports is 24 in. V-shaped stops can be located along the supports at regular intervals and held in place by heavy steel pins.

The maker states that the ram begins its stroke without shock, and that its push is without pulsations.

S. H. D. Automatic Universal Tool-Grinding Machine

The Hotchkiss Co., Paris, France, has recently placed on the market the automatic universal tool-grinding machine of which a general view is shown in the illustration herewith. The machine is primarily intended for grinding lathe, planer, shaper and slotter tools, though attachments for grinding milling cutters and twist drills can be furnished.

The machine is belt driven but can be furnished with motor drive if desired. One of the advantages claimed for the machine is that tools of high-speed steel can be ground without developing cracks on the cutting faces or softening the cutting edges, as the tools are



S. H. D. AUTOMATIC UNIVERSAL TOOL-GRINDING MACHINE

automatically traversed over the face of the wheel and the amount of metal removed at each pass is relatively small.

The reciprocating motion is obtained by an eccentric and an adjustable connecting rod actuated by worm gearing beneath the machine.

The slide rest carrying the toolholder is so arranged

that it can be swung to an angle of 90 deg., and the reciprocation motion obtained from either one of two drums placed at right-angles to each other so that the tool to be ground can be traversed parallel to the axis of the wheel, or at a right-angle thereto. The feed in either case can be operated automatically or by hand. The machine is provided with five stops and four graduated index plates by means of which tools can be set and ground to any desired angle, as shown in the diagram furnished with the machine. A gage attached to the machine provides for setting the tool to the proper height in relation to the grinding wheel.

Among the advantages claimed for this machine are the facilities it gives for the standardization of cutting tools; simplicity and ease of operation; minimum time for setting up to grind tools of any shape, profile or length; accuracy of operation as regards cutting angle, rake and clearance; ability to grind tools with carved faces as accurately as tools with flat faces; high finish given to cutting face; automatic feed and fool-proof in operation.

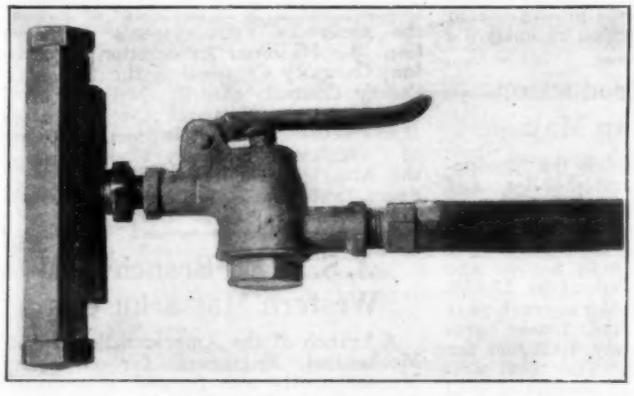
The base of the machine forms a tank for the grinding compound which is circulated by a Brown & Sharpe pump.

The regular equipment includes four grinding wheels, one 8-in. and three 2-in. The large wheel runs at 2,000 r.p.m. and the small wheels at 6,000 r.p.m., and to avoid accidents a stop is provided which prevents the large wheel being run at the higher speed.

The machine is being marketed through J. B. Corrie & Co., 15 Victoria St., Westminster, London, S. W. 1.

Pneumatic Vibrator for Foundry Use

A pneumatic vibrator or "rapper" intended for use in foundries in the operation of withdrawing the upper part of a mold from a pattern or in other industries wherever a gentle jarring action is needed, has been



SMALL FOUNDRY "RAPPER"

placed on the market by the Malleable Iron Fittings Co., Branford, Conn., and is shown in the accompanying illustration.

It operates upon the principle of a pneumatic hammer but is not intended to deliver a blow of any moment. It may be used anywhere that a supply of air under a pressure of 20 lb. or greater is available.

It is always ready for use and may be kept on the molding bench from which it may be picked up and used as readily as an ordinary mallet. The operator has only to place either end of the tool against his flask and press the trigger of the air valve with his thumb.

Johnson No. 300 Soft Metal Melting Furnace

The Johnson Gas Appliance Co., Cedar Rapids, Iowa, has recently placed on the market the melting furnace illustrated herewith and designated as No. 300.

The furnace stands 28 in. high, weighs 100 lb. and has a removable cast-iron melting pot with a capacity for holding 150 lb. of metal.

JOHNSON SOFT METAL MELTING FURNACE

Gas is used for fuel and is delivered to the furnace through three bunsen burners. The maker claims that with a consumption of about 40 cu.ft. of gas per hour a temperature of 2,250 deg. F. can be developed and that melted metal can be kept in the molten state by the use of two burners.

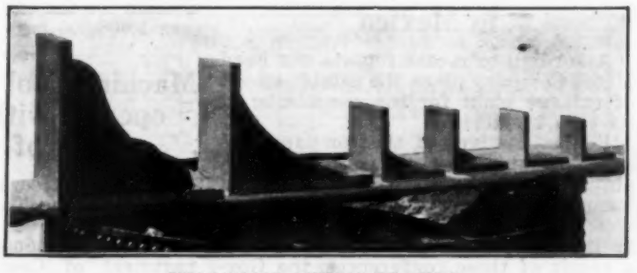
The burners are equipped with shut off valves, pilot lights and regulators. The regulators are constructed with orifices that can be adjusted to varying qualities and pressures of gas and the maker states that by their use a sharp, solid jet of gas can be sent up the center of the mixing tube with great pressure and without the use of a forced air blast or blower, producing a flame of high temperature.

Milliken Angle Plates

The angle plates illustrated herewith have been placed on the market by the Milliken Machine Co., West Newton, Mass.

The angle plates are made in seven sizes and are planed on the outside surfaces and edges.

The sizes range from 3 in. wide by 3¾ x 3¾ in. long,



MILLIKEN ANGLE PLATES

and high to 12 x 12 x 12 in. Beginning with the smallest, Nos. 1 and 2 are without stiffening ribs, Nos. 3, 4 and 5 have one rib and Nos. 6 and 7 have two ribs.

News Section

Railroads Place Locomotive Contracts

According to an announcement made a few days ago the American Locomotive Co. has received orders for twenty-nine new locomotives.

The Chicago & Eastern Illinois contracted for ten Mikado type locomotives weighing 315,000 lb. each, and the Southern Railway's Queen & Crescent division will get fifteen Mikado type locomotives weighing 288,000 lb. each.

The Central America of Cuba, the National Enameling and Stamping Co., the Pittsburgh Plate Glass Co. and the Delaware & Hudson have contracted for one locomotive each of the smaller types.

American Engineers Receive Legion of Honor

The order of Chevalier of the Legion of Honor, according to an announcement made a few days ago by Gaston Liebert, French Consul General, has been conferred on two American engineers. They are Colonel Arthur S. Dwight and Charles F. Rand, president and treasurer, respectively, of the American Institute of Mining and Metallurgical Engineers.

The cross of the order, bestowed for distinguished service during the war, will be conferred by M. Liebert at a luncheon in the Engineers Club on July 20. Colonel Dwight helped organize the First Reserve Engineer Regiment, which as the Eleventh Engineers was the first unit of the American Expeditionary Force to go into action. He was decorated with the Distinguished Service Order by the British and was cited in orders by General Pershing.

Mr. Rand discovered large soft iron ore deposits on the north coast of Cuba and built the Barraco Railroad there. In 1913 King Alfonso XIII of Spain decorated him with the Grand Cross of Knight Commander of the Order of Isabella, Catolica.

Ford Plans Assembly Plant in Mexico

According to recent reports the Ford Motor Company plans the establishment of a large plant for the assembling of its cars in Mexico.

Representatives of the company, the advices stated, recently conferred with authorities of the State of Coahuila and business interests of Saltillo with a view to the possible selection of Saltillo as the site for the proposed plant. As a result of these conferences, the Governor of Coahuila has offered the Ford company all possible facilities, including the donation of land, exemption from taxes for at least fifteen years and any other assistance which it may be possible to extend.

New York Metal Trades Show Employment Increase

According to a statement just issued by the Department of Labor of New York state, based on returns received from 1,514 representative manufacturers there was an increase of 2 per cent in employment during June as compared with the month of May.

The outstanding increase of the month was in the metal and machinery industries, especially in the railroad equipment and repair shops. The firms making locomotives and freight cars reported increases in the number of their employees varying from 15 to 100 per cent. Most of the railway repair shops, especially the locomotive shops, added a large number of workers. The firms making structural steel for building and for railway construction also reported large increases.

Those making heating systems for buildings and car heating apparatus increased their forces. Employment in the iron and steel mills continued to rise. Most of the establishments making automobiles and parts employed more workers in June than in May. There was an increase in the manufacture of airplanes and firearms, but employment in the cutlery industry continues rather low. Among the establishments making machinery and electrical goods there were general increases, especially in the manufacture of elevators, printing machinery and electrical goods, but a decrease in the manufacture of radio equipment, which has been greatly expanded recently.

June Auto Production Greater than May

Preliminary figures for the production of passenger automobiles and trucks during the month of June are reported to show a total of 271,000 machines. This is a gain of 51 per cent over the same month a year ago and exceeds the May output by 15,000. The second quarter of the current year shows 746,000 cars and trucks produced and approximately 1,120,000 for the first half of 1922. The total production for the entire 12 months of 1921 was 1,668,000 cars and trucks.

Machine Tool Builders to Cooperate with the Department of Commerce

The committee appointed by the National Machine Tool Builders' Association to co-operate with the Bureau of Foreign and Domestic Commerce, Department of Commerce, is composed of: J. Wallace Carrel, Lodge & Shipley Machine Tool Co., Cincinnati, Ohio; W. LeCoste Neilson, Norton Co., Worcester, Mass.; Paul E. Thomas, Kempsmith Mfg. Co., Milwaukee, Wis.; J. E. Andress, Barnes Drill Co., Rockford, Ill.

New Foundry Safety Code Approved

Adequate provision for the protection of industrial workers in foundries in the iron, steel, tin, zinc, lead, aluminum, and other industries is included in the National Safety Code for the protection of industrial workers in foundries, which has just been approved by the American Engineering Standards committee.

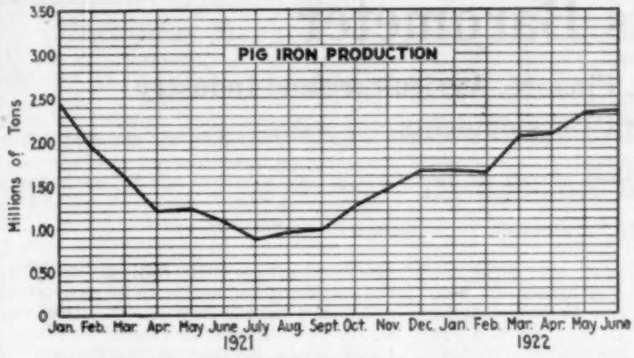
This code is a revision of that developed by the American Foundrymen's Association and the National Founders Association, joint sponsors of the new code. The revision was worked out by a thoroughly representative sectional committee under the auspices and procedure of the American Engineering Standards committee including four representatives of makers and owners of foundry equipment, four of governmental bodies, two of technical associations, two of insurance organizations, and a representative of foundry employees.

The approved code deals with foundry conditions only, omitting such subjects as building construction, exits, stairways, elevators, lighting, sanitation, etc., as these subjects are covered by other codes which have an official status before the American Engineering Standards Committee.

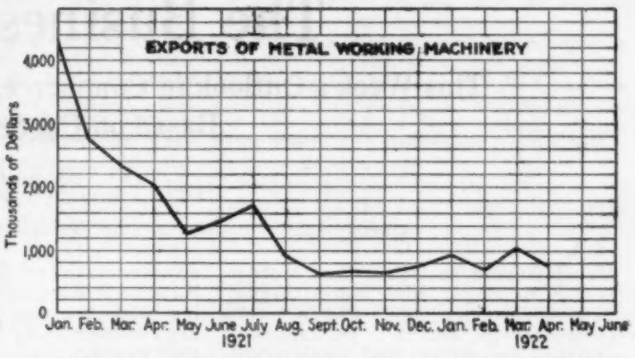
The sectional committee which revised the foundry safety code and recommended it for approval by the A. E. S. C. included representatives of the National Founders Association, the Association of Government Labor Officials, the U. S. Department of Labor, the American Foundrymen's Association, the National Association of Mutual Casualty Companies, the National Safety Council, the U. S. Bureau of Standards, the National Association of Manufacturers, the National Bureau of Casualty and Surety Underwriters, the American Society of Safety Engineers, and the U. S. Public Health Service.

A.S.M.E. Branch for Western Massachusetts

A branch of the American Society of Mechanical Engineers for Western Massachusetts was formed at a meeting in Springfield, July 10. This is in pursuance of a vote at the annual meeting of the Engineering Society of Western Massachusetts to affiliate with the national organizations representative of the different branches of the engineering profession. Charles L. Newcomb, works manager of the Worthington Pump and Machinery Co., Holyoke, was chairman of the organization committee. Officers are to be elected at a later meeting. Plans were discussed for a regional meeting of the American Society of Mechanical Engineers in Springfield, Sept. 25 to 27, with delegates from all New England divisions. It is estimated that the Western Massachusetts branch will comprise 500 members.



Monthly pig iron production of all coke and anthracite furnaces in millions of tons, based on returns compiled by the American Iron and Steel Association.



Total value of all metal working machinery exported monthly from the United States, based on returns compiled by the Bureau of Foreign and Domestic Commerce.

INDUSTRIAL expansion to an extent little realized, no doubt, by the average person is shown in the figures recently compiled by Dow, Jones and Co., indicating that many branches of industry, more particularly the equipment classes, are richer today than ever before in their history. At the close of their last fiscal year, Dec. 31, 1921, companies here selected were in possession of cash working capital more than 100 per cent greater than on December 31, 1914. On December 31, 1921, it is shown that 144 companies were in possesson of cash working capital 100 per cent greater than they possessed on December 31, 1914; in other words, $4,306,708,230 last year as compared with $2,036,611,447 in 1914. The inventories of these same corporations standing at $1,730,217,302 last year, compare with inventories of $3,745,510,950 on December 31, 1920, showing a shrinkage of $2,015,293,648, while the inventories on Dec. 31, 1914, stood at $1,281,306,304. Viewed in the light of the enormous growth of business during the war period, the financial status of these 144 companies is quite close to normal conditions with war earnings largely retained.

Metal working machinery exported from the United States during the month of May had a total value of $892,078, as compared with the April figure of $786,951, and the May total of a year ago of $1,275,971. While a decline is shown from the month of March, the high point for the current year with a total of $1,057,106, the exports for the month, nevertheless, show a steady and sustained improvement taking place since September, 1921. Exports of machinery of all classes for May totaled $19,415,994 as compared with the April total of $19,191,148. Textile and agricultural machinery lead with totals of $1,520,512 and $1,603,574 shown respectively. Exports of lathes were valued at $66,604; boring and drilling machines at $69,424.

Comparative Prices of Shop Supplies

Average of New York, Chicago and Cleveland Prices

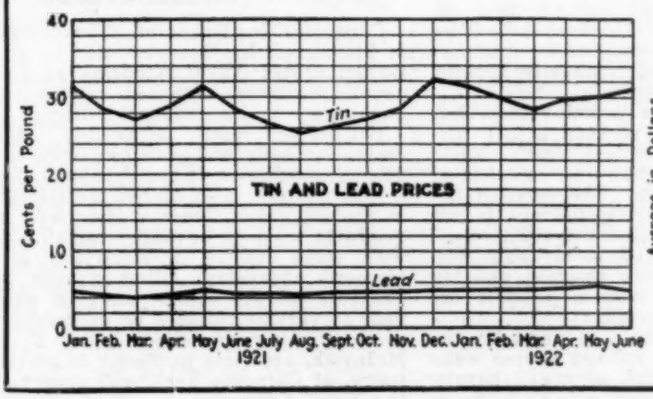
	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.025	$0.0236	$0.0283
Cold finished shafting	per lb.	0.0335	0.032	0.0435
Brass rods	per lb.	0.155	0.1533	0.159
Solder (½ and ½)	per lb.	0.21	0.213	0.203
Cotton waste	per lb.	0.11	0.11	0.122
Washers, cast iron (½ in.)	per 100 lb.	3.83	4.00	4.06
Emery, disks, cloth, No. 1, 6 in. dia	per 100	3.11	3.11	.....
Lard cutting oil	per gal.	0.575	0.608	.....
Machine oil	per gal.	0.36	0.40	.....
Belting, leather, medium	off list	40–5% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in.	off list	55% @60%	60%@ 60–10%	50%@ 60–10%

Pig iron production for June reached 2,361,028 tons, an increase of 45,651 tons over May, and the highest point touched since January, 1921. The figure is especially interesting in view of the coal strike. In many quarters the shutting off of coal production had been looked upon as a factor operating against a favorable iron output.

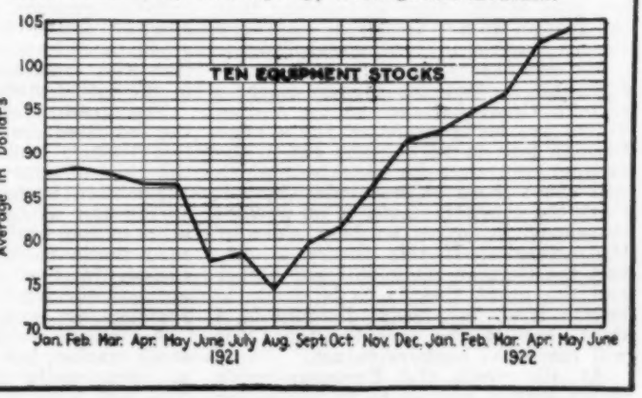
Steel ingot production for the month, according to the compilations made by the American Iron and Steel Institute, amounted to 2,634,477 tons. This is based on the returns filed by 30 companies which, in 1921, produced 87.5 per cent of the total. It is, however, somewhat under the May production of 2,711,141, but may be accounted for by the difference in the number of working days in the two months, and brings the half yearly reported total up to 13,499,386 tons with an apparent total of 15,422,508 tons indicated. Unfilled tonnage of the U. S. Steel Corporation at the end of June stands at 5,635,531 tons, an increase of 381,303 tons over production in May.

Exports of iron and steel for the month of May increased encouragingly. May exports amounted to 230,062 gross tons as compared with 142,551 tons in the corresponding month of last year. Japan continued a heavy buyer but Canada and South America now lead as steel importers.

Monthly average price of tin and lead in the New York market, based on returns furnished by Engineering and Mining Journal-Press.



Monthly average: Am. Brake Shoe; Am. Car and Fdy.; Am. Loco.; Baldwin; Lima Loco.; N. Y. Airbrake; Pressed Steel Car; Pullman; Ry. Steel Spring; Westinghouse Airbrake.



The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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David Harum said that fleas were a blessing to dogs, who were thereby kept from brooding upon the fact that they were dogs, and it is perhaps well that there are strikes and foreign complications to keep American business men from becoming self-conscious of the nation's prosperity. Early last week the strike news and the cables from Germany appeared to indicate serious trouble here and abroad, but the markets were stolid and unaffected. By Wednesday the President had taken action which will probably end both the coal and railway strikes and the German mark, which had sold at .18, was up to .25 on rumors that Germany would be granted a moratorium on her reparation payments.

Prospects for German Loan

It was also reported that France would abate her demands sufficiently to justify the bankers in arranging an external loan to the German republic. Later advices were less definite and the mark reacted to .22, but the tone of the European markets is so much better that the foreign situation is regarded as much more cheerful by those who base their diagnosis upon symptoms rather than the patient's groans.

Meanwhile the Bank of England has reduced its rate to 3 per cent, and a reduction in our own Federal Reserve rate to 3½ per cent is expected and suggested by the weekly statement which shows a gain of $15,000,000 in the gold held and a reserve ratio of 77.3, which is ½ per cent above the previous week. The gain in gold was a surprise. It is understood to be due to the arrival of shipments from Great Britain made to cover at least part of the interest on her debt to our Government.

If these shipments continue the result will be a further reduction in interest rates and a money market in which it may perhaps be possible to float a British loan. By some this is thought to be the purpose that the financiers of Lombard Street have in view, but whatever the object the fact that England is willing to part with her gold at this time is evidence that the British do not anticipate any very serious trouble in continental Europe.

My own theory, which is entirely inferential, is that the money markets of both Great Britain and the United States are being prepared for a huge German loan to be brought out in the autumn and that its issuance, which will cause more or less inflation, will mark the commencement of an upward movement in prices on both sides of the Atlantic. If this theory is correct the German mark will sell higher and the profit that is to be made in buying it at its present discount is, I think, one of the considerations that will move the bankers to act.

At all events the European crisis which earlier seemed to be impending appears to have passed and President Harding's admirable firmness in dealing with the coal and railway strikes argues their early ending. By the time they are ended and the financial distress of Germany has been relieved something else disturbing will no doubt turn up, but until then any review of conditions in the United States must be a twice told tale of prosperity, present and prospective.

The markets are all about normal. The extraordinary activity in building continues. Lumber mills are "getting a flood of new orders" and in New York last week second hand brick sold at $16 a thousand. Continued activity is reported in the steel industry and copper is firm at 14 cents. The dry goods market is normally active. An eager demand is expected at the "spring opening" of the American Woolen Co. next week.

Spun silk has declined nearly 30 cents a pound from the top. The break reflects the weakness in the Japanese market which is in turn probably due to the German crisis. The American demand is, however, quite equal to the offerings at the decline, which has been regarded in the trade as providing manufacturers with an unusual opportunity. The constant increase in the demand for and output of artificial silk is one of the continually surprising sensations of the silk business.

Rubber is quiet but steady pending a definite announcement of an Anglo-Dutch agreement to limit production.

Coffee has been easier and a slight but insignificant recession in the sugar market is to be noted. A better demand and a strong market for hides is reported and the leather trade is improving with prices on choice tannages stiffening.

Crop Outlook Better

Raw cotton and cotton futures have been "fluctious" as usual in the summer time. Unfavorable crop news puts the market up. The converse puts it down. There is, however, a disposition to admit that the crop would be a large one were it not for the weevil and the question of whether this enemy of cotton is quickest killed by arsenate of lime alone, or in combination with molasses, is angrily debated in the cotton states.

The grain crops promise well, but the indicated crop of corn is 221 million bushels under last year's, while the yield of oats shows an increase of 127 million bushels. The total of the spring and winter wheat crops is put at 22 million bushels under 1921. Railroad traffic holds up remarkably well considering the labor troubles and big autumn earnings with a possible car shortage are expected.

A summer somnolence pervades the stock market, but railway shares wake up occasionally and advance sharply. The New York *World* says that "financiers expect a long bull market" and the expectation seems to be reasonable.

Liberty Bonds are all a little more above par. Small investors who bought them as a matter of patriotism and carried them through the depression are now justified in exchanging them for other good securities that will pay more. Good domestic bonds are still readily salable and new offerings are quickly absorbed, but the developments in Germany have "queered" some of the foreign issues recently brought out and the underwriters will have to take them up.

A $10,000,000 loan to Cuba is under consideration and the Republic of Salvador is seeking to borrow $18,500,000 here. Some important public and private issues for Canadian account are also being planned. A marked increase in business activity across the border is reported, but its continuance is to some extent dependent upon the outturn of the wheat crop and the price obtained for it.

Sane protectionists take comfort in the growing opposition to the pending tariff bill and the possibility of its abandonment, while business men generally are glad to hope that the bonus bill has been almost smothered and asphyxiated by the tariff debate. A fellow editor remarks "That special Providence which is said to have a special care for drunken men, little children and the United States evidently continues to be on guard in spite of all our efforts to dislodge it. In spite of turmoil and discouragement abroad which must delay complete recovery we see at home a grateful progress in recovery."

From this cheerful view no careful observer can dissent and for the next few months at least those who calculate upon the normal and allow a reasonable margin of safety are not likely to go far wrong.

Naval Academy Selects Carnegie Institute for Post-Graduate Work

Carnegie Institute of Technology at Pittsburgh has been selected by the United States Naval Academy at Annapolis to give advanced courses in metallurgy to its graduate officers.

Beginning next September, the Naval Academy will send two ordnance officers, graduates of the Academy, for a year's study in advanced metallurgy to the institute. Their studies will be graduate work in advanced metallurgy with some studies in electricity and physical chemistry. Other groups of graduate officers will be assigned each year to various colleges or universities to study along specialized lines. F. F. McIntosh, associate professor in metallurgy, at Carnegie Tech, will supervise the Naval Officers.

Expansion of Australian Machinery Market

A steadily expanding market for machinery in Australia is shown by the latest statistics compiled by the Bureau of Foreign and Domestic Commerce. Imports of industrial machinery, excluding agricultural machinery, amounted to £9,059,871 for the fiscal year ending June 30, 1921, as against £4,302,419 for 1913. A large increase may also be observed in the value and the percentage of machinery imports from the United States in 1921, as compared with pre-war figures. In 1913 American manufacturers furnished machinery valued at £1,245,516, or 29 per cent of the total, as against £3,884,396, or 43 per cent, in the fiscal year ending June 30, 1921.

The following table gives the annual machinery imports into Australia since 1909, showing the participation of the United States and the United Kingdom in this trade:

AUSTRALIAN IMPORTS OF MACHINES AND MACHINERY, INCLUDING MACHINE TOOLS BUT EXCLUDING AGRICULTURAL MACHINERY

Years	Imports from United States Value	Imports from United Kingdom Value
1909	£649,993	£1,684,736
1910	832,694	1,559,504
1911	1,103,686	1,813,345
1912	1,330,537	2,433,860
1913	1,245,516	2,471,6[illegible]8
1914-15	1,305,450	1,932,988
1915-16	1,238,306	1,439,683
1916-17	1,442,303	1,190,000
1917-18	1,240,667	642,079
1918-19	1,960,785	1,068,098
1919-20	2,145,652	1,898,748
1920-21	3,884,396	4,638,997

The following table shows some of the principal items imported from the United States and the United Kingdom 1920-21:

PRINCIPAL MACHINERY IMPORTS INTO AUTRALIA FROM THE UNITED STATES AND THE UNITED KINGDOM IN 1920-1921

Items	1920-21 From United States	1920-21 From United Kingdom
Engines:		
Gas and oil	£164,872	£236,722
Others	250,349	153,629
Machine tools	534,016	849,189
Mining machinery	87,333	44,919
Sewing, stitching, and knitting machinery	401,782	415,392
Printing machinery	192,651	70,996
Electrical machinery, appliances, etc.	777,014	1,087,416
Total	2,408,017	2,858,263

The United Kingdom and the United States have between them practically monopolized the Australian machinery market. The only other countries supplying appreciable quantities are Sweden, Canada, Switzerland, France, and Belgium. Imports from these countries in 1920-21 were as follows: From Sweden, £319,425; Canada, £82,510; Switzerland, £48,931; France, £26,914; and Belgium, £11,200.

German goods have been excluded by the provisions of Australian wartime legislation, but beginning next August they may again enter the field. Machinery imports from Germany attained a maximum of £387,100 in 1913, which represented only 9 per cent of the total imports in that year.

The growth in imports from the United States, as compared with the pre-war years, is particularly striking in view of the advantages enjoyed in the Australian market by the United Kingdom, among which may be mentioned substantially heavy preferential tariffs; favorable exchange rates; and close political, commercial, and financial affiliations. Many of the dealers in imported machinery have intimate connections with Great Britain, and some are actually branches of British houses. A considerable number of Australian industrial establishments are financed by British capital. As regards the matter of commercial facilities, three of the most important banks in Australia are British and the rest have branches in Great Britain, while no American banks have yet been established in Australia.

Australia is developing steadily and American machinery manufacturers should not overlook the opportunities presented for the future. The estimated value of Australian production by industries is indicated in the accompanying table, from the latest quarterly summary of Australian statistics (December, 1921). The amounts shown under the heading "Manufacturing" comprise the value added by the process of manufacture; in other words, the difference between the cost of the raw material and the value of the finished product. It will undoubtedly surprise many to observe that manufacturing is Australia's second industry in importance.

ESTIMATED VALUE OF AUSTRALIAN PRODUCTION

Items	1910	1913	1919-20
Agricultural	£39,752,000	£46,162,000	£72,234,000
Pastoral	56,993,000	57,866,000	109,062,000
Dairy, poultry, and bee farming	17,387,000	20,341,000	38,830,000
Forestry and fisheries	4,789,000	6,338,000	10,170,000
Mining	23,222,000	25,810,000	19,725,000
Manufacturing	45,598,000	61,586,000	98,162,000
Total	187,741,000	218,103,000	348,183,000

Washington Notes

By Paul Wooton

A torpedo plane, the last word in aircraft construction of its kind, will be evolved from tests at present under way at the Naval Air Station, Anacostia, under the supervision of the Bureau of Aeronautics, according to reports issued by the Navy department. Daily test flights, with types of torpedo planes which embody the most advanced ideas of foreign and American builders, are being held under the direction of the foremost authorities on Naval aircraft design, and the next few weeks should give to Naval aviation the best torpedo plane in the world.

A. H. G. Fokker, designer and builder of the famous Fokker monoplane used by Germany during the World War for pursuit and combat work, is now at Anacostia. He is directing the tests of his own plane, which is an adaptation of the famous German Fokker, improved and redesigned to meet the requirements of swift and accurate torpedo attack by airplane on battleships. In competition with the Fokker plane are types of British and American design, and with the rigid tests under way each type is being judged on its merits.

These developments are merely in line with a consistent policy of leading the world in advanced ideas along the lines of national security—a policy which discards the obsolete and forges to the front with the best in the interest of national defense.

The War Department appropriation bill carrying funds for the year which began July 1, by approval of Congress and the President, authorizes $26,250 for the Ordnance Department of the army for testing machines for materials of this department.

Appropriations for the District of Columbia for the year which began July 1, under Congressional allotment, include $250,000 for repairing the heating and ventilating systems in District public schools; $45,000 for tools and machinery for manual training instruction; and $12,500 for a pumping engine, triple expansion, motor driven, for the fire department.

The War Department appropriation bill whose funds became available July 1 on approval by Congress and the President authorizes the expenditure of $150,000 for the construction at the army barracks in the Hawaiian Islands of a refrigerating plant.

Brazil Will Hold Engineering Congress

Of special interest to *American Machinist* readers is the announcement that *Ingeniería Internacional*, the McGraw-Hill Spanish publication, is the recipient of signal honors. From Sebastiao Samparo, commercial attache of the Brazilian Embassy, Washington, D. C., has come a pressing and cordial invitation. It is an invitation to take part in the International Congress of Engineering to be held in Rio de Janeiro, Sept. 7 to 30, 1922.

The date, September 7, is important for it marks the first centenary of Brazilian independence. Not only will the International Congress of Engineering be opened on that date, but the republic, on that day also, will throw open the gates to her great International Exposition with ceremonies befitting so momentus an occasion.

And a momentus occasion it will surely be. With infinite wisdom this new republic has paid a rare tribute to the engineering profession. She has recognized the premier place of the technical man in world industrial development. She has sensed the benefits to be derived from gathering them together on her shores; and she charged her own Club de Engenharia in the city of Rio with the huge task of organizing an International Engineering Congress, instructing its members to spare no expense to make it a success. An effort such as this bespeaks an ardent desire on the part of Brazil to promote an international fraternal feeling among the engineering profession. More than that, it shows how keen she is to acquaint the profession with the stupendous problems confronting her in the development of the vast resources within the borders of the republic. For this reason the congress deserves the serious thought of every reader interested in expanding the markets for American machinery.

Subjects of a far reaching nature are to be brought before the meeting. They are subjects of great moment to Brazil and her future industrial development and in lending the republic assistance in solving the great problems there is to be found an excellent opportunity to sow seeds for future trade.

The director of *Ingeniería Internacional*, V. L. Havens, is preparing to

attend the Congress and the exposition. He will go as a representative of the paper, and possibly, also, as a representative of one or more engineering societies. In the firm belief that Brazil's problems of railway, iron and steel, coal and other industrial development hold opportunity of inestimable value during the next decade, the *American Machinist* will take pleasure in passing to Mr. Havens any inquiries its readers may have regarding the congress and its aims.

Rio is less than a fortnight distant from New York. What a wonderful opportunity for machine tool builders to enjoy a healthful vacation and establish connections of great future worth!

Business Items

The Standard Mold Co., Akron, Ohio, manufacturers of rubber molds, cores and various specialties, has awarded a contract for the construction of a new building which, it is stated, will increase its present production by approximately 50 per cent.

The Auto Specialties Co., St. Joseph, Mich., with a branch plant at Windsor, Ont., manufacturer of automobile jacks, shock absorbers, malleable castings, etc., is disposing of a bond issue of $350,000, a portion of the proceeds to be used for plant extensions.

The Doehler Die Casting Co., Court and Ninth Streets, Brooklyn, N. Y., has arranged for an increase in capital from $1,500,000 to $2,000,000.

The Turner Machine Co., 28 Eagle Street, Newark, N. J., manufacturer of special machinery, has arranged for an increase in capital from $25,000 to $350,000 for general expansion.

The Detroit Stoker Co., 7342 Woodward Avenue, Detroit, Mich., has acquired the plant of the Van Blerck Motor Co., Monroe, Mich., for a consideration of close to $75,000. The new owner will use the plant for the manufacture of stokers and parts, and will take immediate possession. Employment will be given to about 200 men.

The Bethlehem Motors Corporation, Allentown, Pa., recently organized to take over the plants and assets of the former corporation of the same name, has arranged for the immediate resumption of operations at the Pottstown, Pa., works. Repairs and improvements will be made to machinery and a working force recruited at once. The plant will be operated on a 10-hour day basis, the same as the main works at Allentown, which recently was started up.

The Reliance Steel and Tool Co., 24 Murray Street, New York, N. Y., has filed notice of reduction in capitalization from $500,000 to $10,000.

The Vaughn and Bushnell Manufacturing Co., 2114 Carroll Avenue, Chicago, Ill., manufacturer of tools, has filed notice of increase in capital from $50,000 to $400,000, and 3,000 shares of stock, no par value, for general expansion.

The Franklin Automobile Co., Syracuse, N. Y., is reported to have finished the month of June by breaking all previous production records for that month. The output was the second largest monthly production in the history of the company.

The Westinghouse Electric International Co., Mexico City, Mexico, it is announced, recently has taken larger quarters in the Boker Building, Isabel la Catolica, and 16 de Septiembre Streets with C. V. Allen, for many years manager of Westinghouse interests in Mexico, in charge.

The W. R. Martin Co., Louisville, Ky., is reported to have closed a contract recently for the equipment necessary for the installation of a complete forge shop in which its business in forging for the mining industry will be taken care of.

The Westinghouse Electric International Co., Buenos Aires, Argentina, announces the occupation of larger quarters in that city, the new address being Avenida de Mayo 1031, with Louis F. Peck as managing director.

The Manufacturers' Tool and Supply Co., South Bend, Ind., now located at 314 St. Joseph St., has broken ground at the corner of S. Main and Calvert Sts. for their new building. The structure which will be of concrete and 55 by 132 feet is expected to be finished by September 1.

The Black & Decker Manufacturing Co., Townson Heights, Baltimore, Md., paid a dividend of 2 per cent on the preferred stock for the second quarter and at the same time paid a dividend of 2 per cent for the fourth quarter of last year.

The Branford Brass Foundry Co., Inc., Branford, Conn., has been incorporated under the laws of Connecticut, to engage in the brass foundry business. The company will have a capital stock of $50,000, and the incorporators are: Albert V. Neilson, Frederick A. Ells, and Hugh A. Cox, of the town of Branford.

The Collins Co., manufacturers of tools, Collinsville, Conn., held their annual meeting at Hartford, Conn., July 11, elected Charles E. Chase, chairman of the board of the Hartford Fire Insurance Co., Hartford; and Anson T. McCook, as directors to succeed Richard C. Colt and William Hill. The officers chosen include: Charles L. Taylor, president; C. H. Clark, vice-president; F. Spencer Goodwin, secretary; and Meigs H. Whaples, treasurer, and these together with Arthur L. Shipman, Edward K. Root, Walter L. Goodwin, William A. Hitchcock, George H. Sage, Philip B. Gale, and Charles E. Chase, constitute the board of directors.

The Guy Steel Casting Co., West Hartford, Conn., has recently filed papers of incorporation under the laws of Connecticut. The capital stock of the company is $50,000, and they will carry on a business of metal casting and steel treating. The incorporators of the company are: W. R. Bennett and John E. Sinnott, both of Hartford, Conn., and George B. Kinghorn, of Southington, Conn.

Personals

R. J. COBBAN has been made manager of the Butte office, Westinghouse Electric and Manufacturing Co.

W. T. BLACKWELL has been appointed manager of the interior lighting section of the merchandising department, Westinghouse Electric and Manufacturing Co., with headquarters at South Bend, Ind.

J. G. BENEDICT, general manager of the Landis Machine Co., Waynesboro, Pa., sailed July 8th for a combined business and pleasure trip abroad. Mr. Benedict will be gone for about two months and his itinerary will include England, France, Holland, Belgium and Germany.

J. W. ROBINSON has been promoted to the managership of the central station division, of the Chicago office, Westinghouse Electric and Manufacturing Co.

EDWARD R. ABBOTT, formerly New York representative for the Taft-Peirce Manufacturing Co., is now with the Du Pont Engineering Company, Wilmington, Delaware, as sales representative for their Wilmington shops, recently opened to contract work as a permanent feature of the Du Pont activities.

NORMAN STEWART of the Chicago office, Westinghouse Electric and Manufacturing Co., has been appointed branch manager of the Minneapolis office of the company.

WILLIAM F. NANK, formerly auditor of the Carroll Foundry and Machine Tool Co., has been appointed branch manager of the Mason Tire and Rubber Co., Kent, Ohio, with headquarters in Canton.

C. E. ALLEN, of the Chicago office, Westinghouse Electric and Manufacturing Co., has been appointed district manager of the St. Louis office.

A. C. HABERKORN, formerly Detroit branch manager of Manning, Maxwell & Moore, Inc., and E. E. Wood, formerly sales manager of the Jones & Lamson Machine Co., have formed a partnership under the name of Haberkorn & Wood and have opened an office and warehouse at 620 E. Hancock Ave., Detroit, Michigan, where they will handle a line of machine tools, cutting oils and compounds and permanent mould aluminum castings.

D. O. TYLER has just been made manager of the turbine section, Westinghouse Electric and Manufacturing Co., Pittsburgh.

HARRY B. CURTIS, secretary and treasurer, of the Bridgeport Hardware Manufacturing Co., Bridgeport, Conn., was elected a member of the board of directors of the Mechanics and Farmers Savings Bank of Bridgeport, at its annual meeting held July 11.

Obituary

CHARLES PHILLIPS, superintendent of the Bridgeport Metal Goods Manufacturing Co., Bridgeport, Conn., died at his home in that city, July 4, after a short illness. Mr. Phillips was fifty-nine years old, and at one time was connected with the Bridgeport Brass Co., Bridgeport, in an official capacity.

HARVEY E. MILLER, vice-president of the Fairbanks Co., of Cuba, died July 9 at Hutchinson, Kan., from injuries he received in the Santa Fé collision at Burrton, Kan., on the day before.

Mr. Miller and his father before him

were pioneers in the scale business. He was 62 years old and had been with the Fairbanks Co. for forty-two years. As a boy he learned to build scales from his father and soon became an expert.

JOHN M. GOODWIN, general manager of the New Process Twist Drill Co., Taunton, Mass., died on July 4.

WILLIAM T. MURPHY, president of the Standard Machinery Co., Auburn, and prominent in manufacturing circles throughout Rhode Island, died at Greenfield, Mass., July 9, following a three days illness.

Mr. Murphy was a member of the Providence Chamber of Commerce and president of the Metal Trades Council. He was a native of Providence and was 40 years of age. He received his early schooling at the Point Street grammar school and English high school. At the conclusion of preparatory courses he entered Brown University, from which he was graduated in 1903.

A few months later he became associated with the late Michael J. Houlihan in the construction of machinery, and eventually the machine company of which he was the head was established. Recognized as the practical man in the promotion of the Standard Machinery Company, he succeeded Mr. Houlihan as president.

THEODORE J. MENTON, vice-president, Schaeffer and Budenberg Manufacturing Co., Brooklyn, N. Y., died July 9, at his home in that city. He was born at Elgin, Ill., forty-five years ago and had been a resident of Brooklyn for thirty years. He had been connected with the manufacturing company for twenty-five years.

J. HOBART BRONSON, president and treasurer, of the Oakville Co., manufacturers of metal and wire goods, Oakville, a suburb of Waterbury, Conn., died at his summer home in Litchfield, Conn., July 6, after a very brief illness. Mr. Bronson, who was eighty years old, was about in his usual health the day previous to his death. He was formerly president of the Citizens National Bank of Waterbury, Conn., and has been prominent in industrial and civic affairs in and about Connecticut. Mr. Bronson is survived by his wife, one son, Captain Bennet Bronson, two grandchildren, and a brother, Dr. Edward B. Bronson, of New York city.

Book Reviews

Human Factors in Industry. By Harry Tipper, manager, Automotive Industries. Published by the Ronald Press Co., New York City, cloth binding, 280 pages, price $2.

Probably at no previous period has there existed so great a need for an intensive study and a clear conception of the strong currents of economics and sociology, more especially that subdivision known as the labor problem, than there does today. Certainly in no previous period have men of industry, employers of labor and executives generally, had so little cause to complain of a lack of literature on the subject from the pens of able minds. True enough, much of it is burdensome and tiresome to read, but here and there exceptions are found—exceptions in the form of short, clear-cut discussions of the great subject. Of such is the little book of less than 300 pages from Mr. Tipper, which has been issued only recently by the Ronald Press.

In the opening chapters the author surveys the growth and development of labor unions and the trade union idea during the past century. An analysis of the currents and counter currents operating in present day industry in general, their connection with group organization among manufacturers, and the much-discussed collective bargaining schemes occupy the early chapters.

Just what the outlook is for various proposals intended to correct the situation, as it is generally known, is surveyed in the latter part of the book. Bonus and profit sharing systems, wage schemes, incentive and fatigue are investigated and their values set down. The final chapters are devoted to an analysis of the industrial relations departments, the open shop and the immediate future outlook.

Notes on Mechanical Drawing. By Rolland S. Wallis. Paper cover, 64 pages. Published by the engineering extension department, Iowa State College, Ames, Iowa, price 50 cents.

The book is a supplement to the drawing courses conducted by that department, and is an elementary discussion of the technique of various drafting tools, the principles of projection, lettering and drafting room geometry.

Pulling Together. By John T. Broderick. With introduction by Charles P. Steinmetz. One-hundred-forty-one 5 x 7 in. pages, red cloth boards. Published by Robson & Adee, Schenectady, N. Y. Price $1.

A book dealing with human relations in industry, advocating in particular employee representation in management. The story is presented as a dialogue between the president of a corporation employing 30,000 people and a traveling machine tool salesman. On account of the style adopted and the plain, direct way of telling, the book will make excellent reading for both plant executive and for employee. It will probably not leave the plant owner or manager entirely sold on the matter of employee representation, but will go far to convince him that there is much to be said for it and that it might under the right conditions and if properly applied solve many of his labor difficulties.

Labor leaders, minor executives and those they direct, if open-minded, should profit by a reading of "Pulling Together," if only to be told again that "the interests of those engaged in industry, whatever the nature of the functions they exercise or of the service they perform, are, or should be, identical, not dissimilar, and therefore that their relations should be harmonious, not antagonistic." Also "that the industrial system is dependent for its existence upon co-ordinated effort and the human beings who supply that effort have motives and purposes that are common and cannot be otherwise."

Graphical Methods. William C. Marshall, M.E., C.E. First edition. McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York, and 6 and 8 Bouverie St., London, E. C., England. Two hundred and fifty-three 6 x 9-in. pages and 220 illustrations. Price $3.

Graphs have come into such universal use that a book of this kind, containing as it does, examples of graphs for almost every conceivable purpose together with full and complete instructions for their preparation and use, is of incalculable value to the business as well as the professional man.

The book opens with an introduction giving a short but comprehensive history of graphical methods and a list of their classification. The various chapters cover "Kinds of Graphs," "Making of Diagrams," "Applications," "Determination of Laws," "Routing and Organization," "Calculations," "Nomography and Mechanical Records."

Trade Catalogs

Boring and Turning Mills. The Colburn Machine Tool Co., Cleveland, Ohio. Bulletins B-101, B-102 and B-103 descriptive of Colburn heavy duty boring and turning mills. Bulletin B-101 contains details and specifications on the 42 in. machine, while bulletin B-102 is descriptive of the 90 in. machine.

Oil Burning Systems. Schutte & Koerting Co., Philadelphia, Pa. A general catalog just off the press, containing complete descriptive and technical data on the Koerting fuel oil burning systems. The various bulletins composing the catalog contain considerable general information on the installation, operation and maintenance of oil burning plants, their requirements, characterisics and functions. Contained also within the pages are a great many illustrations in color and 25 tables of important data.

Milling Machines. The Ingersoll Milling Machine Co., Rockford, Ill. A circular letter in folder form with cuts showing a four head Ingersoll adjustable rail milling machine and its use on special work in various manufacturing plants.

Arc Welding in Electric Railway Shops. The Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa. Leaflet No. 1824, describing arc welding on worn and broken brake shoes, bearings, frames, bolsters, etc. Illustrations showing methods are given as are also figures showing the savings possible in reclaiming worn out parts.

Tool Steel. Vanadium-Alloys Steel Co., Latrobe, Pa. A sixteen-page bulletin on the subject of non-shrinkable die steel with useful information regarding methods to be followed in its heat treatment.

Resistance Thermometry. The Brown Instrument Co., Philadelphia, Pa. Catalog No. 90, consisting of 24 pages, containing a discussion of resistance thermometry. Various types of resistance thermometers are illustrated and described with instructions given regarding their operation, care and maintenance.

Twist Drills. The Whitman and Barnes Co., Akron, Ohio. Circular letter in folder form containing illustrations showing the application of the company's twist drills and reamers to various types of work.

Bolt and Nut Machinery. Pawtucket Manufacturing Co., Pawtucket, R. I. A bulletin of twenty-three pages, containing illustrations and specifications pertaining to the numerous sizes of cold-punched nut presses made by this company for the production of square and hexagon U. S. Standard nuts; a twelve-page bulletin descriptive of various sizes of bolt forging machines; a twelve-page bulletin containing data and illustrations on several sizes of bar, lever and cutting shears; a four-page circular describing the two sizes of Knowles key-seating machines.

(We regret that the title of the above mentioned catalog was printed incorrectly last week as **Bolt and Hub Machinery** and are pleased to correct the error.)

Pamphlets Received

Changes in the Economic Life of the Chinese People. Trade information Bulletin No. 5 by Julean Arnold, Commercial Attache, American Embassy, Peking, published by the Department of Commerce, Washington.

Commercial Aviation-Air Mail Service. A pamphlet of 168 pages with index, being the hearings before the committee on Post Roads of the House of Representatives on the bill H. R. 11193 to encourage commercial aviation.

Forthcoming Meetings

Association of Iron and Steel Electrical Engineers. Annual convention, Sept. 11 to 15 at the new auditorium, Cleveland, Ohio. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

American Institute of Mining and Metallurgical Engineers, annual convention, Sept. 25 to 28, 1922, San Francisco, Cal. Secretary, F. F. Sharpless, 29 West 39th Street, New York city.

American Society for Steel Treating. Exposition and convention at the General Motors Co. building, Detroit, Oct. 2 to 7. W. H. Eisenman, 4,600 Prospect Ave., Cleveland, is secretary.

American Manufacturers Export Association annual convention, New York City, Oct. 25 and 26. Secretary, M. B. Dean, 160 Broadway, New York City.

National Machine Tool Builders' Association. Annual convention, New York city, October, 1922. Secretary, E. F. Du Brul, 817 Provident Bank Building, Cincinnati, Ohio.

National Founders Association, Nov. 22 and 23. Secretary, J. M. Taylor, 29 South La Salle St., Chicago, Ill.

The Weekly Price Guide

RISE AND FALL OF MARKET

Advances—Maximum quotations on steel sheets at Pittsburgh mill, 10c. higher on blue annealed and galvanized; 15c. per 100 lb. on black. Structural steel quoted at minimum of $1.70, f.o.b. Pittsburgh, on current business; $1.80 on small tonnages with deliveries uncertain. Price of $1.60 per 100 lb., however, still existent on contracts, for large tonnages, already made with regular trade. Electrolytic copper market quiet but firm; fabricated copper and brass products up ½c. per lb. in New York warehouses. Zinc market showing strong upward trend, prices firm. Flaxseed market tending upward; linseed-oil higher. Raw oil up 2c. in Chicago and 8c. per gal., 5 bbl. lots, in Cleveland.

Declines—Tin quoted at 31½c. as against 31¾c. and lead at 6c. as compared with 6¼c. per lb., in New York warehouses, one week ago.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.00
Northern Basic	26.52
Southern Ohio No. 2	26.02
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	31.16
BIRMINGHAM	
No. 2 Foundry	20.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	27.82
Virginia No. 2	29.24
Basic	25.50
Grey Forge	25.50
CHICAGO	
No. 2 Foundry local	24.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	27.17
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.00
Basic	25.00
Bessemer	25.00

IRON MACHINERY CASTINGS—In cents per pound:

	Light	Medium	Heavy
Detroit	10.0	8.0	3.0
New York	9@10	6.0	3.0
Cleveland	6.75	4.5	2.6
Chicago	5.0	4 5	3.5
Cincinnati	6.0	5.0	4.5

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2 40@2.60	3.63	3.25	3.63
No. 12	2.45@2.65	3.68	3.30	3.68
No. 14	2.50@2.70	3.73	3.35	3.73
No. 16	2 70@2 90	3.83	3.45	3.83
Black				
Nos. 17 and 21.	3.00@3.25	4.15	3.80	4.30
Nos. 22 and 24.	3.05@3.30	4.20	3.85	4.30
Nos. 25 and 26.	3.10@3.35	4 25	3.90	4.35
No. 28	3.15@3.40	4 35	4.00	4.45
Galvanized steel sheets:				
Nos. 10 and 11.	3.15@3.35	4.35	3.85	4.45
Nos. 12 and 14.	3.25@3.50	4.45	3.95	4.55
Nos. 17 and 21.	3.55@3.80	4.75	4.25	4.85
Nos. 22 and 24.	3.70@3.95	4.90	4.55	5.00
No. 26	3.85@4.10	5.05	4.70	5.15
No. 28	4.15@4.40	5.35	5.00	5.45

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
		BUTT WELD			
1 to 3	71	58½	¾ to 1½	44½	29½
		LAP WELD			
2	64	51½	2	39½	25½
2½ to 6	68	55½	2½ to 4	42½	29½
7 to 8	65	51½	4½ to 6	42½	29½
9 to 12	64	50½	7 to 12	40½	27½
		BUTT WELD, EXTRA STRONG, PLAIN ENDS			
1 to 1½	69	57½	¾ to 1½	44½	30½
2 to 3	70	58½			
		LAP WELD, EXTRA STRONG, PLAIN ENDS			
2	62	50½	2	40½	27½
2½ to 4	66	54½	2½ to 4	43½	31½
4½ to 6	65	53½	4½ to 6	42½	30½
7 to 8	61	47½	7 to 8	35½	23½
9 to 12	55	41½	9 to 12	30½	18½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	66%	53%	60½%	47½%	62½%	48½%
2½ to 6 in. steel lap welded	61%	47%	58½%	44½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 10%. Cast iron, standard sizes, 32–5% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6@8	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.85
Hoop steel	3.63	2.81	3.48
Cold rolled strip steel	6.25	8.25	6.15
Floor plates	4.80	4.66	5.08
Cold finished shafting or screw	3.35	3.30	3.40
Cold finished flats, squares	3.85	3.80	3.90
Structural shapes (base)	2.68	2.51	2 68
Soft steel bars (base)	2.58	2.41	2.58
Soft steel bar shapes (base)	2.58	2.41	2.58
Soft steel bands (base)	3.23	3.06	3.23
Tank plates (base)	2.68	2.68	2.38
Bar iron (2.20 at mill)	2.58	2.21	2.28
Drill rod (from list)	55@60%	55%	50%
Electric welding wire:			
5/32	8.00		12@13
⅛	6.50		11@12
3/32 to ¼	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.62½
Tin, 5-ton lots, New York	31.50
Lead (up to carlots), St. Louis, 5.50; New York	6.00
Zinc (up to carlots), St. Louis, 5.30; New York	6.12½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	19.20	20.00	18.00
Antimony (Chinese), ton spot	5.50	7.50	6.25
Copper sheets, base	21.00	21.00	23.00
Copper wire (carlots)	16.50	17.00	16.25
Copper rods (ton lots)	19.50	22.00	19.50
Copper tubing (100-lb. lots)	23.75	24.00	23.00
Brass sheets (100-lb. lots)	17.25	18.00	18.75
Brass tubing (100-lb. lots)	21.00	21.00	20.50

—Shop Materials and Supplies

METALS—Continued

Brass rods (1,000-lb. lots)	15.25	16.00	15.75
Brass wire (carlots)	17.75	17.75	.....
Zinc sheets (casks)	8.25	17.25	15.75
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	.....
Solder (½ and ½), (caselots)	21.00	22.00	20.00
Babbitt metal (fair grade)	24.25	41.50	36.00
Babbitt metal (commercial)	11.00	16.00	9.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	11.75	11.50
Copper, heavy, and wire	11.75	11.25	10.50
Copper, light, and bottoms	9.75	9.50	9.75
Lead, heavy	4.75	4.75	4.75
Lead, tea	4.25	3.50	3.75
Brass, heavy	7.00	6.00	7.00
Brass, light	6.00	5.00	6.00
No. 1 yellow brass turnings	6.50	6.00	6.50
Zinc	3.00	3.00	3.00

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

		New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:				
IC,	20x28, 112 sheets	20.00	18.25	18.50
IX,	20x28, 112 sheets	23.00	21.00	20.90
"A" Charcoal Allaways Grade:				
IC,	20x28, 112 sheets	17.00	16.00	17.00
IX,	20x28, 112 sheets	20.00	18.75	19.60
Coke Plates, Bright				
Prime, 20x28 in.:				
100-lb.,	112 sheets	12.50	11.00	14.50
IC,	112 sheets	12.80	11.40	14.80
Terne Plate				
Small lots, 8-lb. Coating:				
100-lb.,	14x20	7.00	5.60	7.25
IC,	14x20	7.25	5.85	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.07½@$0.10	$0.12	$0.11½
Cotton waste, mixed, per lb.	.055@.09	.09	.08
Wiping cloths, 13¼x13¼	..... per M.	50.00 per lb.	.10
Wiping cloths, 13¼x20½	..... per M.	55.00 per lb.	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, 360 lb. bbl., per 100 lb	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.93	1.15	.98
White lead, dry or in oil	100 lb. kegs.	New York,	12.50
Red lead, dry	100 lb. kegs.	New York,	12.50
Red lead, in oil	100 lb. kegs.	New York,	14.00
Fire clay, per 100 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville	per net ton		$9.00
Coke, prompt foundry, Connellsville	per net ton		$9.00

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	50%	65–10%	60%
1½ and 1¼x3 in. up to 12 in.	33⅓%	60%	60-10%
With cold punched sq. nuts	35%	.....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	40%	.....	$4.00 off
Button head bolts, with hex. nuts	25%	$3.90 net	.....
Hex. head and hex. nut bolts	30%	.....	65-5%
Lag screws, coach screws	50%	.....	60-5%
Square and hex. head cap screws	70–10%	75%	70-10%
Carriage bolts, up to 1 in. x 30 in.	40%	60%	50–5%
Bolt ends, with hot pressed nuts	50%	.....	55%
Tap bolts, (h.h. plus std. extra of 10%)	10%	.....	.....
Semi-finished nuts ⅝ and larger	65%	70–10%	80%
Case-hardened nuts	60%	.....	.....
Washers, cast iron, ⅛ in., per 100 lb. (net)	$4.50	$3.50	$3.50
Washers, cast iron, ¼ in. per 100 lb. (net)	3.75	3.50	3.50
Washers, round plate, per 100 lb. Off list	3.50	....	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	2.00	3.50	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	2.00	3.50	4.00
Nuts, cold punched, sq., per 100 lb. Off list	2.00	3.50	4.00
Nuts, cold punched, hex., per 100 lb. Off list	2.00	3.50	4.00
Rivets:			
Rivets, ⅞ in. dia. and smaller	60-5%	70%	60-10%
Rivets, tinned	60-5%	70%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb (net)	$4.00	$3.25	$3.10
Cone heads, ditto (net)	4.10	3.35	3.20
1½ to 1¾-in. long, all diameters, *EXTRA* per 100 lb	0.25	.....	0.15
⅝ in. diameter *EXTRA*	0.15	.....	0.15
½ in. diameter *EXTRA*	0.50	.....	0.50
1 in. long, and shorter *EXTRA*	0.50	.....	0.50
Longer than 5 in. *EXTRA*	0.25	.....	0.25
Less than 200 lb *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.35	.....	$3.35 base
Copper rivets	55–5%	50%	50-%
Copper burs	35%	50%	20%

Lard cutting oil (50 gal. bbl.) per gal.	$0.55	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., $2.88			
Medium grade	40–5%	40–10–2½%	50%
Heavy grade	35%	40%	40–5%
Rubber and duck:			
First grade	60–5%	50–10%	40-10%
Second grade	60–10–5%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	$5.84	$3.85	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	32.75	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	.....	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	.....	1.40
Cloth	3.02	.....	3.20

New and Enlarged Shops

Machine Tools Wanted

Conn., Bridgeport—The Amer. Chain Co., Inc., 920 Connecticut Ave.—one power press, scope 10 or 12 in. with a bolster plate about 30 x 30 in. (used).

Conn., Bridgeport—Auto Owners Repair Wks., 4008 Main St., F. Scherer, Purch. Agt.—one internal grinder, and a large back-feed drill press.

Conn., Bridgeport—The Butler Machine Co., foot of Pembroke St.—one set Warner boiler bending rolls, 8 ft. long, with drop housing.

Conn., Bridgeport—The Dawn Mfg. Co., 552 Fairfield Ave., manufacturer of washing machines, R. A. Leckie, Purch. Agt.—one four-spindle press, one 20 in. back feed drill press, one plain milling machine.

Conn., Bridgeport—The Grant Mfg. & Machine Co., Silliman Ave., W. B. McNaughton, Purch. Agt.—one No. 0 and one No. 1 wire feed screw machines (Brown & Sharpe).

Conn., Bridgeport—The Lacey Mfg. Co., 50 Middle St., F. G. Hubbard, Purch. Agt.—one No. 2 Bliss arch screw press.

Conn., Bridgeport—The Prestoy Mfg. Co., 910 Connecticut Ave., (metal stampings, etc.)—one 30 in. power shear for cutting stock up to .030 in.

Conn., Bridgeport—Roosa Auto Repair Wks., 75 Evitts Lane—one small lathe for garage.

Conn., Bridgeport—United Welding & Repair Co., 1772 Main St.—one double spindle drill press and small lathe.

Kan., Rosedale—Millers Shop, 106 Alsey Ave.—adjustable wheel chuck, Universal face plate, and spring chuck, No. 2 Mosley lathe.

Kan., Wichita—North Main Street Garage, 717-719 North Main St., W. L. Gunn. Purch. Agt.—gear cutting machine (power equipment).

Kan., Wichita—The Rex Auto Specialty Co., 630 North Main St., J. Taylor, Purch. Agt.—power drill press, lathe, belting, boring machine, gear cutting machine, shafting, hangers, bearings, and pulleys, for manufacturing auto accessories.

Kan., Wichita—Square Deal Furniture & Clothing Co., 334 North Main St., A. L. Fisher, Purch. Agt.—drill press, lathe and small tools.

La., Shreveport—Southwestern Gas & Electric Corp.—equipment for new machine shop.

Mich., Bay City—Garber Machine Co.—equipment for foundry and machine shop including one stave rattler, iron and wooden flasks, ladles with shanks, 9 in. cupola fan, large portable coke core oven.

Mich., Detroit—Best Stove & Stamping Co., 145 East Atwater St.—press for making metal stampings for stove parts.

N. J., Trenton—Skillman Hardware Mfg. Co., West End Ave.—two presses for stamping room.

N. Y., Buffalo—F. M. Beck, 235 Porter Ave.—machinery and equipment for garage on Ellicott St.

N. Y., Buffalo—Bd. Educ., 1401 Telephone Bldg., will receive bids until July 26 for Vocational School equipment—milling machines, shapers, engine lathes, interior sliding spindle, drill press, high speed metal saw, floor grinders and bench lathes. Printing equipment including automatic feeder, Mergenthaler No. 5 machine and magazines. Automobile equipment including electric motor drills, bench grinders, high speed motors, test bench starter and generator vise, and tube vulcanizing equipment. Oxy-acetylene welding equipment (complete). Electrical equipment including motor generator set (complete), high speed, ball bearing, spindle sensitive drill, motor head engine lathe, 715 r.p.m. motor complete with rails and fitted with pulleys, 9 in. diameter, 8 in. face. Woodworking equipment including patternmakers' lathe.

N. Y., Buffalo—Regent Motor Car Corp., Inc., c/o C. E. and H. E. Barnes—equipment for the manufacture of gasoline engines.

N. Y., Buffalo—J. Van Ravels, 1314 Fillmore St.—small tools, machinery and equipment, also one 1,050 gal. tank for service station on Filimore and Rodney Aves.

N. Y., Endicott—Endicott Forging & Mfg. Co., North St.—additional machinery and tools.

N. Y., New York—Flywheel Exchange, 213 West 64th St.—one No. 2 Miller with dividing head, quick change lathe.

O., Akron—Mechanical Mold & Machine Co., Crosier and High Sts.—equipment for machine shop.

O., Canton—Rose Spring & Machine Co., 12th St., N. E., D. Rose, Purch. Agt.—one Head cylinder grinding machine, and other smaller machine tools for proposed shop addition.

O., Wadsworth—Ohio Injector Co., C. E. Young, Supt.—lathes, boring machines, drill presses and other machinery for machining valves, etc.

Okla., Picher—The American Machine Wks.—engine lathe, 24 to 28 in.

Pa., East Pittsburgh — Westinghouse Electric & Mfg. Co.—hand shears and equipment for tin shop at Trafford City, Pa.

Pa., Phila.—Hellwig Silk Dyeing Co., 9th and Buttonwood Sts., J. Knup, Sr., Purch. Agt.—lathes, planers, drill presses, etc., for machine shop.

Pa., Phila.—Proctor & Swartz Co., 7th St. and Taber Rd.—auto screw machines, lathes, planers, boring mills, and other machinery for new factory.

Pa., Sellersville—United States Gauge Co.—grinding machine equal to Brown & Sharpe No. 2 Universal. Must be 90% new.

Vt., St. Albans—Central Ry. of Vermont, H. M. Dewart, Purch. Agt.—additional machine tools.

Va., Richmond—Allen & Pietri, 1215 West Broad St.—one medium lathe, 1 acetylene welding machine, and a motor complete with valves and tanks.

Va., Richmond—Alsop Motor Corp., 918 West Broad St.—small lathe, drill press, arbor press, and emery wheel.

Va., Richmond—J. A. Heisler, 309 North Laurel St.—one electric drill and small lathe.

Va., Richmond—Holland & Snead, 412 North 5th St.—one small lathe for auto repair shop.

Va., Richmond—T. T. Hulcher, 7 South 7th St.—large lathe.

Va., Richmond—Layne Auto Repair Shop, 221 West Broad St.—lathe and drill press.

Va., Richmond—Sallerwhite Machine Shop, 1424 East Franklin St.—milling machine.

Va., Richmond—J. H. Shoot Machine Shop, 1445 East Franklin St.—key way cutter.

Va., Richmond—D. W. Vaughn & Son, 820 West Broad St.—lathe, drill press and emery wheel.

Va., Richmond—G. C. White & Son, 406-408 North 5th St.—drill press, hand electric drill, and small lathe.

Wis., Appleton—Fox River Auto Co., Washington St.—machinery for auto repairs, also air compressor and electric motor.

Wis., Appleton—G. R. & S. Motor Co., 738 Washington Ave.—equipment for auto repair shop.

Wis., Manitowoc—Aluminum Goods Mfg. Co., 15th and Franklin Sts., G. Vitts, Purch. Agt.—rolling mill presses.

Wis., Menasha—Jaeger-Wheeler Co., 417 2nd St.—machinery for proposed auto repair shop at Neenah.

Que., Montreal—I. Benoit, 2163 Clare St., —machinery and equipment for proposed garage ($75,000).

Que., Montreal—Hart Motor Co., Registered, 19 Concord St.—lathe and small tools for automobile repair shop.

Machinery Wanted

Ala., Brewton—Neal Lumber & Mfg. Co., E. L. McMillan, Pres.—machinery and equipment for the manufacture of lumber.

Ala., Ensley—Storey-Matthews Mfg. Co. —woodworking machinery for the manufacture of furniture.

Ala., Fairfield—Chickasaw Bldg. & Car Co.—machinery and equipment for proposed foundry.

Ark., Arkansas City—Moore Oil & Refining Co.—machinery and equipment for proposed addition.

Cal., San Jose—The California Prune & Apricot Growers' Assn., Market and San Antonio Sts.—machinery and equipment for by-products specialty plant.

Cal., Susanville—California Fruit Growers' Exchange—machinery and equipment for fruit packing house.

Conn., Bridgeport—Acme Metal Treating Co., 513 John St., H. F. Sanford, Purch. Agt.—furnaces for heat treating, also pressure blowers.

Conn., Bridgeport—The Feeney Tool Co., 751 Central Ave.—full equipment for proposed foundry (small).

Conn., Litchfield—Bantam Ball Bearing Co., Bantam St.—machinery and equipment for addition to factory.

Fla., Lakeland—Lurie Sugars, Inc.—machinery and equipment for the manufacture and refining of sugar, also for the cultivation of sugar cane.

Fla., Tampa—The Electric Motor Co., 114 South Franklin St.—machinery and equipment for new plant addition.

Ind., Petersburg—Simplex Lock Rim Co., (manufacturer of metal rims for auto wheels)—machinery for addition to plant.

Kan., Hardtner—S. M. Mercer—leather working machinery, including one harness sewing machine and hand creaser.

Kan., Wichita—Haines & Noll, c/o Haines Tile & Mantel Co., 152 North Market St.—machinery for the manufacture of tile, belting, hangers, pulleys, shafting, etc.

Kan., Wichita—Miller Theatre, North Market St., S. Chambers, Purch. Agt.—refrigeration cooling system for theatre, $50,000.

Ky., Horse Cave—W. A. McGuire—machinery and equipment for creamery and cold storage plant.

Mich., Detroit—Ford Motor Co., Highland Park—equipment for assembling automobiles for proposed new factory addition.

Mich., Marion—The Press—one 8 column folio chassis.

Mo., Cape Girardeau—The Missourian—printing equipment for newspaper plant.

Mont., Billings—Northwest Refining Co., R. M. Hodgens, Mgr.—machinery and equipment for proposed refinery at Laurel.

Neb., Cambridge—J. W. Hammond—one 2 revolution pony press.

Neb., Lincoln—W. A. Parvins Garage, 821 South 11th St.—one air compressor (200 lb. pressure), ¾ hp. motor attached, horizontal type (used).

N. Y., Buffalo—Bd. of Supervisors of Erie County, 29 City and County Hall, E. F. Jeackle, Clk.—machinery and equipment for laundry, bakery, and work shop at the County Home, at Wende.

N. Y., Buffalo—Great Lakes Dredge & Dock Co., Morgan Bldg.—machinery and equipment for repair shop at the foot of Katherine St.

N. Y., Buffalo—Lautz Marble Corp., 861 Main St.—machinery and equipment for cutting and dressing marble, for proposed factory at 7 Norfolk Ave.

N. Y., Buffalo—E. F. Neubecker, 334 Colvin St.—machinery for cabinet work and for the manufacture of window frames, plant on Cornwall Ave.

N. Y., Buffalo—J. F. Pfister Co., 22 Metcalfe St.—machinery and equipment for vinegar and pickle factory.

N. Y., Buffalo—Queen City Candy Co., 453 Jefferson St., M. Brownstein, Purch. Agt.—machinery and equipment for candy factory at 396 Broadway.

N. Y., Buffalo—Twin Filter Co., Inc., c/o G. W. Barker, Dir., 78 Tioga St.—machinery for the manufacture of water filters.

N. Y., Buffalo—T. Tzelzo, 5 West Chippewa St.—machinery and equipment for proposed candy factory at 452 Pearl St.

N. Y., Cattaraugus—Setter Bros., Inc., machinery for the manufacture of wood engraving blocks, veneers, etc.

N. Y., East Rochester—Erie Mop & Wringer Co., West Commercial St.—additional machinery and equipment.

N. Y., Geneva—Rice Bros. Nurseries Co., Fram Castle Rd., J. F. Rice, Mgr.—equipment for new $75,000 packing plant and storage buildings, now under construction.

N. Y., Jamestown—Colonial Engraving Co., Inc., c/o L. C. Petrie, R. D. No. 75—equipment for printing, publishing and engraving plant.

N. Y., Jamestown—Empire Case Goods Co., 142 Foote St.—machinery and equipment for proposed plant, for the manufacture of dining room furniture.

N. Y., New Rochelle—V. Mastromarino, 253 Huguenot St.—wrecking crane for garage and service car use.

N. Y., Salamanca—H. Neff—machinery and equipment for proposed 600 ton coaling station.

N. Y., Watkins—S. N. Gutwater Co.—machinery and equipment for the manufacture of Christmas tree ornaments, for remodeled factory on Franklin St.

N. C., Asheville—Biltmore Industries—one Davis & Furber 48 in. wool card (late model).

N. C., Gibsonville—O. W. Mann Lumber Co., J. W. Burke, Purch. Agt.—additional machinery for plant.

N. C., Lincolnton—Lincolnton Creamery & Ice Co.—ice and refrigeration machinery.

N. C., Rose Hill—The Atlantic Coffin & Casket Co., E. M. Carr, Mgr.—one 6 x 15 in. moulder for woodworking shop, Yates or Woods preferred (used).

O., Bellaire—C. L. Dorer Fdry. Co.—machinery and equipment for proposed foundry addition.

O., Cleveland—The City of Cleveland, Comr. of Purchases and Supplies, City Hall—one 4 ton gasoline industrial locomotive crane.

O., Columbus—Columbus Builders Supply Co., 145 North Front St., H. K. Hill, Vice Pres.—loading and unloading machinery, aerial tramway, etc.

O., Columbus—Expression Piano Player Co., 1278 West Broad St., C. E. Bard, Genl. Mgr.—woodworking machinery, including small saws, planers and cutters, also some metal working machinery.

O., Columbus—W. L. Lillie Co., 233 East Gear St.—$200,000 worth of woodworking machinery for proposed factory.

O., Columbus—J. H. and F. A. Sells Co., Chestnut and Pearl Sts., manufacturer of horse collars and pads—special machinery for factory nearing completion at 280 North 6th St.

Pa., Connellsville—Fayette Baking Co. (Connellsville), Purch. Agt. for Premier Baking Co., New Kensington—conveying machinery.

Pa., Erie—Union Iron Wks., Inc., 15th and Cascade Sts., G. W. Bach, Genl. Mgr.—machinery and equipment for iron works, foundry, etc.

Pa., Leechburg—Bd. Educ.—equipment for vocational dept. of new high school.

Pa., New Castle—R. D. Yaple, 107 South Mulberry St.—one large size power loom for weaving heavy rugs.

Pa., Nordmont—C. W. Sones, c/o Nordmont Chemical Co.—machinery and equipment for saw mill; also machinery and equipment for proposed clothes pin factory.

Pa., Phila.—Hulton Dyeing Co., 3819 Frankford Ave., M. B. Kampe, Purch. Agt.—bleaching and dyeing machinery.

Pa., Phila.—B. S. Pincus Co., 21st and Market Sts.—conveyors, grinding machines, refrigerating and other machinery for packing plant.

Pa., Phila.—G. Spruance Co., 312 North 3rd St.—grinders, mixers, etc., for paint factory.

Pa., Phila.—L. Sternberg, 1208 Race St.—English necktie frames, also machinery for manufacturing full fashioned neckties.

Pa., Sewickley—Bd. Educ.—equipment for vocational dept. of proposed high school.

Pa., Sharon—G. Boyadjis, West State St. mechanical refrigeration machinery for remodeled restaurant.

Pa., Sharon—Standard Tank Car Co.—additional machinery for proposed car and assembling plant addition.

Pa., Sharpsville—J. A. Bolton—tools, air compressor, etc., for gas filling and service station now under construction.

Va., Richmond—J. T. Nuckols, (contractor), 7th and Duval Sts.—six 4 ton scales for new freight depot of Chesapeake and Ohio Ry. Co., Brooke Ave., Norfolk.

Wis., Altoona—Bd. Educ.—equipment for manual training dept. and laboratory in new high school.

Wis., Appleton—J. Conway, Oneida and Washington Sts.—laundry equipment including mangles, tumblers, and mechanical dryers, etc.

Wis., Green Bay—H. F. Witlig, Route 1—laundry machinery including a tumbler and dryer.

Wis., Hawkins—Northern Sash & Door Co., J. Jesdahl, Purch. Agt.—woodworking machinery.

Wis., Madison—The Kennedy Dairy Co., 618 University Ave.—refrigerating machinery for proposed ice cream factory.

Wis., Manitowoc—Aluminum Goods Mfg. Co., 15th and Franklin Sts.—one 20 ton crane for use in warehouse.

Wis., Milwaukee—The Holeproof Hosiery Co., 404 Fowler St.—special machinery for knitting hosiery.

Wis., Milwaukee—N. K. Lambro, 636 35th St.—electrically driven shoe repair machinery.

Wis., Milwaukee—H. Wilhelm, 600 1st Ave.—crushing machinery.

Wis., Neenah—C. A. Douglas, 251 East Dewey Ave.—belt or electric driven air compressor.

Wis., Neenah—F. S. Durham, 206 West Wisconsin Ave. (feed grinding, etc.)—one attrition mill with electric motor.

Wis., Waukesha—Harvey Paper Specialty Co., Main St.—special machinery.

Wis., Waupun—A. N. King—job press for power equipment (size 12 x 18).

Ont., Petrolia—Peninsula Sugar Co.—complete equipment for proposed sugar refinery, daily capacity 600 tons.

Ont., Toronto—The Provisional Government—conveyors for storage of coal and hoists for dairy building at Guelph Agricultural College.

Que., Montreal—Shell Oil Co., 3608 Notre Dame St.—tanks, gasoline and oil handling equipment for proposed distributing stations.

Que., Montreal—E. C. Vinet, 547 Iberville St.—forge and other equipment for blacksmith shop.

Metal Working Shops

Cal., Richmond—Republic Steel Package Co., 7930 Jones Rd., Cleveland, O., plans to build a branch factory here, for the manufacture of steel tanks and oil field equipment. Private plans.

Cal., San Francisco—E. T. Meakin, 409 6th St., has awarded the contract for the construction of a 1 and 2 story, 75 x 100 ft. machine shop on South west Folsom and 14th Sts. Estimated cost $18,000.

Cal., San Francisco—J. Pasqualetti, Humboldt Bank Bldg., is having plans prepared for the construction of a 2 story garage on Bush and Franklin Sts. Estimated cost $40,000. Meyer & Johnson, 742 Market St., Archts.

Cal., Vallejo—The Western Die Casting Co., 2927 Newbury St., Berkeley, has awarded the contract for the construction of a 1 story, 125 x 162 ft. factory on Nape St., here, for the manufacture of Wmslow carburetors. Estimated cost $25,000. Noted June 1.

Conn., Milldale—Clark Bros. Bolt Co. has awarded the contract for the construction of a 1 story, 50 x 105 ft. factory addition. Estimated cost $25,000.

Ill., La Grange—Kastory Mfg. Co., 301 Hillgrove Ave., has awarded the contract for the construction of a 1 story, 100 x 125 ft. factory, for the painting and repairing of auto bodies.

Ind., Indianapolis—R. H. Hassler, Inc., 1535 Naomi St., plans to build a 3 story, 37½ x 120 ft. sales and service station on Meridian and Joseph Sts. Estimated cost $75,000. Fitton & Mothershead, 540 North Meridian St., Archts.

Mass., Lowell—Saco-Lowell Shops, 77 Franklin St., Boston, is having plans prepared for the construction of a factory additions, for the manufacture of textile machinery, on Kitson St., here. Architect not announced.

Mich., Detroit—Ford Motor Co., Highland Park, plans to build a 1 story, 245 x 1570 ft. automobile factory (addition to former Lincoln plant) on Livernois Ave. A. Kahn, 1,000 Marquette Bldg., Archt.

Nev., Reno—Washoe County, E. H. Beemer, Clk., will receive bids until July 29 for the construction of a garage. G. A. Ferris & Son, Colonial Apts., Archts.

N. J., Camden—Cadillac Auto Co., 525 Market St., is having plans prepared for the construction of a 4 story, 48 x 126 ft. auto show room and service station on 11th and Market Sts. Estimated cost $100,000. Lackey & Hettel, 509 Federal St., Archts.

N. Y., Batavia—C. Mancuso & Son, 322 Main St., has awarded the contract for the construction of a 2 story, 81 x 100 ft. garage and salesroom. Estimated cost $40,000.

N. Y., Green Island—The Ford Motor Co., Highland Park, Mich., has awarded the contract for the construction of a 1 story automobile factory here.

N. Y, Retsof—Retsof Mining Co. has awarded the contract for the construction of a machine shop. Estimated cost $225,000.

N. Y., Rochester—Gallagher Motor Co., Inc., plans to build a 72 x 150 ft. garage and salesroom, 32 ft. high, on Monroe Ave. Estimated cost $50,000. Architect not announced.

O., Cleveland—I. Feigenbaum, Ulmer Bldg., is having plans prepared for the construction of a 1 story, 40 x 120 ft. garage at 3643 Carnegie Ave. Estimated cost $50,000. Best & Hoefler, 6523 Euclid Ave., Archts.

O., Cleveland—W. Koehl, Archt., Park Bldg, is receiving bids for the construction of a 2 story, 50 x 130 ft. commercial building and garage addition on West 30th St. and Lorain Ave., for West Center Sales Co., c/o Architect. Estimated cost $50,000.

O., Cleveland—The Standard Equipment Co., Lorain Ave. and West 106th St., plans to build a 1 story, 60 x 200 ft. forge shop. Estimated cost $40,00. I. T. Domizi, Lorain Ave. and West 106th St., Engr. and Archt.

O., Cleveland—Studebaker Corp. of Amer., 2020 Euclid Ave., has awarded the contract for the construction of a 3 story, 140 x 148 ft. service building on East 25th St. near Payne Ave. Estimated cost $250,000. Noted July 22.

Pa., Phila.—Hellwig Dyeing Co., 9th and Buttonwood Sts., has awarded the contract for the construction of a 1 story, 40 x 100 ft. and 40 x 240 ft. machine shop in the Wissinoming Dist.

Pa., Phila.—Procter & Swartz Co., 6th St. and Tabor Rd., will build a 1 story, 125 x 450 ft. machinery factory. Estimated cost $100,000. Private plans.

Pa., Phila.—Universal Service Motor Co., 1407 Locust St., has awarded the contract for the construction of a 6 story, 70 x 116 ft. garage on Broad and Manning Sts. Estimated cost $250,000.

Pa., Sharon—Standard Tank Car Co. will build a 50 x 100 ft. car and assembling plant addition. Estimated cost $75,000.

Wis., Appelton—G. R. & S. Motor Co., 738 Washington Ave., is having plans prepared for the construction of a 1 story 100 x 320 ft. garage. Estimated cost $40,000. E. A. Wettingel, 578 Pierce Ave., Archt.

Wis., Neenah—Jaeger-Wheeler Co., 417 2nd St., Menasha, is having plans prepared for the construction of a 2 story, 50 x 95 ft. garage and repair shop on Main and Commercial Sts. Estimated cost $40,000.

Wis., Neenah—E. A. Wettengel, Archt., 578 Pierce Ave., Appleton, is receiving bids for the construction of a 1 story, 50 x 50 ft. and 60 x 120 ft. garage on North Commercial St., here, for Jaeger-Wheeler Co., Neenah. Estimated cost $45,000.

B. C., Kimberley—Consolidated Mining & Smelting Co., Ltd., will build a 500 ton concentrator plant. Private plans.

Mexico, Coahuila—Amer. Smelting & Refining Co., 120 Bway., New York, N. Y., will construct a smelting and refining plant, here, including several buildings. Estimated cost $7,000,000. Private plans.

Ont., Ford—Ford Motor Co. of Canada has purchased an extensive site, and is having plans prepared for the extension of its auto factory and the construction of a plant for the manufacture of tractors. Estimated cost $6,000,000.

General Manufacturing

Ark., Arkansas City—Moore Oil & Refining Co., plans to build an addition to its refinery, will increase its daiy capacity from 6,000 to 10,000 bbls.

Cal., Oakland—Antiseptic Laundry Co., 3960 Manila Ave., has awarded the contract for the construction of a 1 story laundry addition on Bway. near 40th St. Estimated cost $7,500.

Cal., Pittsburgh—The California Bean Growers' Assn., 120 Battery St., San Francisco, has awarded the contract for the construction of a 1 story, 80 x 350 ft. warehouse, and a 5 story, 20 x 40 ft. mill, 1st unit of their plant here. Estimated cost $80,000. Noted July 13.

Cal., Sacramento—Consumers Ice & Cold Storage Co., 801 D St., will repair and build additions to its plant. Estimated cost $19,500.

Cal., San Francisco—Eames Co., 55 1st St., manufacturer of truck and wheel goods, is having plans prepared for the construction of a 1 story factory on Howard St. near 5th. M. V. Politeo, 1st Natl. Bank Bldg., Archt.

Cal., San Francisco—Petri Italian-American Cigar Co., Inc., 419 Jackson St. has awarded the contract for the construction of a 4 story, 137 x 137 ft. cigar factory on Battery and Vallejo Sts. Estimated cost $200,000.

Cal., San Mateo—E. Riggins (publisher San Mateo News-Leader), has awarded the contract for the construction of a 1 story publishing plant. Estimated cost $10,800.

Fla., Orlando—W. F. Blackman and Associates plan to build an ice and cold storage plant. Estimated cost from $50,000 to $100,000.

Ill., Chicago—Natures Rival Co., 306 South Franklin St., has awarded the contract for the construction of a 3 story, 133 x 166 ft. factory, for the manufacture of brassieres and corset accessories, on Irving Park Blvd. and Hermitage Ave. Estimated cost $180,000. Noted June 29.

Ill., Chicago—O. V. Palmquist & Co., 4884 North Clark St., has awarded the contract for the construction of a 1 story, 60 x 163 ft. factory, for the manufacture of sash, doors and blinds, at 5915-23 East Ravenswood St. Estimated cost $40,000.

Ill., Chicago—U. S. Sample Co., 901 South Wells St., has awarded the contract for the construction of a 6 story, 125 x 125 ft. printing plant, on Jackson and Tafiin Aves. Estimated cost $350,000.

Ill., North Chicago—Davis-Watkins Dairymen's Mfg. Co., 130 North Wells St., Chicago, has awarded the contract for the construction of a 1 story, 100 x 140 ft. addition to its plant here. Estimated cost $70,000.

Ind., Indianapolis—Enquirer Printing Co., 309-11 East Ohio St., plans to build a 3 story, 58 x 85 ft. printing plant. Estimated cost $60,000.

La., Swartz—The Palmer Trust Co., Shreveport, plans to build a large gasoline absorption plant, here, daily capacity 25,000,000 cu.ft. Architect not announced.

Me., Portland—Oakhurst Dairy Co., Forest Ave., plans to build a 2 story dairy also a power plant unit. Estimated cost $100,000.

Mass., Belchertown—Dept. of Mental Diseases, State House, Boston, has awarded the contract for the construction of a 2 story service, and two two dormitory buildings, at State Colony Group, here. Estimated cost $250,000.

Mass., Palmer—D. O. Pease Mfg. Co., 161 Summer St., has awarded the contract for the construction of a 1 story, 75 x 200 ft. yarn mill. Estimated cost $45,000.

Mass., Pittsfield—Berkshire Woolen & Worsted Co., Pecks Rd., has awarded the contract for the construction of a 2 story, 60 x 100 ft. spinning mill and carding building, at its plant. Estimated cost $40,000.

Mass., South Boston (Boston P. O.)—John West Thread Co., 297 Congress St., Boston, has awarded the contract for the construction of a 2 story, 60 x 200 ft. addition to its plant on Covington St. Estimated cost $100,000.

Minn., Minneapolis—The Royal Wet Wash Laundry Co., 1401 Plymouth Ave., had plans prepared for the construction of a 2 story, 88 x 140 ft. addition. Estimated cost $45,000. J. B. Greenberg, Mgr. Liebenberg, Kaplin & Martin, 617 McKnight Bldg., Archts.

Mont., Laurel—Northwest Refining Co., Billings, plans to build a refinery here, daily capacity 2,000 bbls. R. M. Hodgens, Billings, Mgr. H. O. Simmone, c/o owner, Engr.

N. J., Trenton—Skillman Hardware Mfg. Co., West End Ave., has awarded the contract for the construction of a 1 story, 32 x 60 ft. hardware plant on Edgewood Ave. Estimated cost $5,000.

N. J., Trenton—Whitehead Bros. Rubber Co., Whitehead Rd., has awarded the contract for the construction of a 2 story, 45 x 60 ft. rubber plant. Estimated cost $25,000.

N. Y., Buffalo—Lautz Marble Corp., 861 Main St., plans to build a marble work shop at 7 Norfolk Ave. Estimated cost $85,000. Private plans.

N. Y., Buffalo—J. F. Pfister, 22 Metcalfe St., plans to build an addition to vinegar and pickle factory. Estimated cost $15,000.

N. Y., Rochester—Rectograph Co., Inc., 307 St. Paul St., plans to build a 1 story factory for the manufacture of photo supplies, on Hollenback St. Estimated cost $16,000.

N. Y., Wende—The Bd. of Supervisors of Erie Co., 29 County Hall, Buffalo, will receive bids until July 25 for the construction of an administration, bakery, laundry and other buildings at the County Farm here. Estimated cost $225,000.

N. C., Lincolnton—Lincolnton Creamery & Ice Co. plans to rebuild its ice plant which was recently destroyed by fire. Estimated cost $100,000. Architect not announced.

O., Cleveland—Cleveland, Kraut & Pickle Co., 1191 East 22nd St., is receiving bids and opens same about Aug. 1, for the construction of a 2 story, 60 x 80 ft. factory at 3333 Lakeside Ave. Estimated cost $50,000. D. S. Duncan, Secy. and Mgr. Private plans.

O., Cleveland—Cleveland Sanitary Wipers Co., 5815 Bway, plans to build a 2 story factory. Estimated cost $50,000. S. I. Fineman, Mgr. Architect not selected.

O., Cleveland—Wilberite Roofing Co., 3700 Brook Park Rd, has awarded the contract for the construction of a 1 story, 35 x 130 ft. heating house. Estimated cost $40,000.

O., Dayton—Lowe Bros. Co., 450 East 3rd St., has awarded the contract for construction of a 7 story, 30 x 270 ft. mill, for the manufacture of paint, on Wayne Ave. Estimated cost about $175,000.

Okla., Ardmore—R. H. Harris & Son, Ada, plans to build a plant here, for the manufacture of bricks, about 20,000 daily capacity. Private plans.

Pa., Berwyn—Hester Price Canning Co. plans to rebuild its canning factory which was recently destroyed by fire. Estimated cost $40,000. Architect not announced.

Pa., Erie—Bd. Educ. will receive bids until Aug. 20 for the construction of a 2 story, 200 x 300 ft. high school, containing a vocational department, on West Side. Estimated cost $425,000. W. W. Myers, Library Bldg., Archt.

Pa., Mercer—Raymilton Refining Co., Raymilton, plans to build a refinery, here; will also remove its plant from Raymilton to Mercer in the early spring. Capacity of present plant to be increased 5 times. A. Hastings, Raymilton, Mgr.

Pa., Phila.—Hulton Dyeing Co., 3819 Frankford Ave., has awarded the contract for the construction of a 2 story, 62 x 203 ft. dyeing factory on Coral St. and Wheatsheaf Lane. Estimated cost $60,000.

Pa., Phila.—B. S. Pincus, 21st and Market Sts., has awarded the contract for the construction of a 3 story, 48 x 100 ft. packing plant at 454 North American St. Estimated cost $90,000.

Pa., Phila.—R. E. White, Archt., Penna. Bldg., is receiving bids for the construction of a 2 story, 62 x 138 ft. factory, for the manufacture of paint, on Richmond and Tioga Sts., for G. Spruance, 312 North 3rd St. Estimated cost $50,000.

Pa., Reading—Central Abattoir Co., Chestnut St., will soon receive bids for the construction of a 3 story addition to its packing plant. Estimated cost $175,000. Himmelsbach & Schlich, 136 Liberty St., New York, Engrs. Noted June 15.

Tex., Cross Plains—J. D. Ford (representing owner) plans to build a large oil refinery on Haley Farm. Private plans.

Wis., Madison—The Kennedy Dairy Co., 618 University Ave., has awarded the contract for the construction of a 2 story, 85 x 132 ft. ice cream factory. Estimated cost $80,000. Noted June 1, 1922.

Wis., Milwaukee—Federal Eng. Co., 444 Milwaukee St., is receiving bids for the construction of a 6 story, 64 x 64 ft. textile mill addition on 5th St., for the Holeproof Hosiery Co., 404 Fowler St. Estimated cost $50,000.

Wis., Racine—H. & M. Body Corp., 608 Center St., has awarded the contract for the construction of 26 additional dry kilns, and also for alterations to its plant. Estimated cost $200,000. Noted June 29.

Wis., Waukesha—Harvey Paper Specialty Co., Main St., plans to build a 1 story 80 x 122 ft. plant. Estimated cost $40,000. Architect not selected.

Wyo., Casper—The Texas Co., Battery Pl., New York, plans to build an oil refinery, here.

Ontario—Pure Gasoline Co., 13 King St. W., Toronto, has purchased sites in Kitchener and Niagara Falls, and is having plans prepared for the construction of gasoline stations. Estimated cost $50,000. Private plans.

Ont., Guelph—The Provisional Government, Toronto, will soon receive bids for the construction of a dairy and cold storage equipment for Guelph Agricultural College, here. Estimated cost $96,000 and $17,000 respectively. Educ. Dept., Toronto, Archts.

Ont., Hamilton—Canadian By-Products Co., Home Bank Bldg., will soon have plans prepared for the construction of a plant for the manufacture of fire bricks. Estimated cost $35,000.

Ont., London—Shell Oil Co., 3608 Notre Dame St., Montreal, Que., has purchased site here and will build a receiving and distributing station. Estimated cost, $250,000.

Ont., Milton—Milton Pressed Brick Co., 48 Adelaide St., West Toronto, will build a new down draft brick kiln, here.

Ont., Palmerston—I.X.L. Mfg. Co. plans to rebuild its 2 story battery factory which was recently damaged by fire. Estimated cost $25,000. Private plans. J. Youngson, Mgr.

Ont., Petrolea—Peninsula Sugar Co. has had plans prepared and will take bids about Aug. 1 for the construction of a 1 and 2 story, 250 x 800 ft. sugar refinery, and a 1 story, 175 x 225 ft. power house. Estimated cost $1,000,000. F. H. Hubbard, Genl. Mgr. A. Schoen, Archt. Honolulu Iron Wks., 8047 Hamilton Blvd., Detroit, Mich., Engrs. Noted Dec. 22.

Ont., Toronto—Farmers Dairy Co., Walmer Rd., has awarded the contract for the construction of a 2 story, 106 x 120 ft. addition to its dairy. Estimated cost $175,000.

Ont., Welland—Welland Cotton Mills, Ltd., is having plans prepared for the construction of a cotton mill on Queen and Duncan Sts. Estimated cost $200,000. L. B. Spencer, 60 Merritt St. W., Secy. W. J. Westaway Co., 38 Main St. W., Hamilton, Archts.